

New Bedford/Fall River *Commuter Rail* PROJECT



Expanded Alternatives Analysis

*prepared for the
Massachusetts State
Legislature*

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Prepared by the



**Massachusetts Bay
Transportation Authority**

in cooperation with

Central Transportation Planning Staff
Vanasse Hangen Brustlin, Inc.
LS Transit Systems, Inc.
Sverdrup Civil, Inc

NEW BEDFORD / FALL RIVER COMMUTER RAIL EXTENSIONS EXPANDED ALTERNATIVES ANALYSIS

Executive Summary

In May, 1995, the Massachusetts Bay Transportation Authority (MBTA) completed an *Expanded Feasibility Study* to evaluate the potential for extending commuter rail service to the southeastern Massachusetts communities of New Bedford, Fall River and Taunton. Following public comment and review of this study, the MBTA initiated engineering and design work to construct a rail extension via the so-called Attleboro route. This effort was stopped in January, 1996, in response to concerns expressed by communities along the proposed right-of-way.

In August 1996, the Massachusetts State Legislature directed the MBTA to further study all viable alternatives for extending commuter rail service to both New Bedford and Fall River. This report is prepared in response to this directive and includes the cost, projected ridership and a proposed operational scenario for each alternative. An assessment of the potential impacts of each alternative is also included.

Alternatives Considered

Eight commuter rail alternatives, running along three alternate routes, and an enhanced commuter bus option were considered.

Route	Alternatives	Description
via Attleboro	1A and 1B	Extension would branch from the MBTA's Attleboro line north of Attleboro station; use a 2½-mile bypass to connect to the Attleboro Secondary; and serve two Taunton stations before branching to New Bedford and Fall River.
via Middleborough	2A, 2B, 2C and 2C-1	Service would be extended from the Middleborough/Lakeville terminal now being constructed as part of the Old Colony project. The line would follow the Middleborough Secondary and serve one Taunton station before branching to the south.
via Stoughton	3A and 3B	Involves an extension of the MBTA's Stoughton Branch. Service would be provided to Easton, Raynham, and Taunton before branching to New Bedford and Fall River.
via Commuter Bus	4	Involves improvements to the existing commuter bus services now operating from New Bedford, Fall River and Taunton.

Alternative 1A via Attleboro and Alternative 3A via Stoughton consider the addition of New Bedford/Fall River service along the existing MBTA Attleboro or Stoughton lines; these options are similar to those evaluated in the 1995 study. Ridership and cost estimates differ from the 1995 results due to the fact that service plans have been modified and more detailed engineering has been performed.

Alternatives 2A, 2B, 2C and 2C-1 consider extending service along the Middleborough branch of the Old Colony system. In response to the legislative directive, these options each provide service to *both* New Bedford and Fall River. These Middleborough line alternatives were designed to test the feasibility of: extending Old Colony service (Alternative 2A); adding more service on the Old Colony Main Line (Alternative 2B); relocating Lakeville station to provide faster service (Alternatives 2C and 2C-1); and, using a shuttle service to supplement service levels south of Taunton (Alternatives 2B and 2C-1).

Alternatives 1B and 3B considered the use of diesel-multiple units (DMUs) in an effort to operate more cost-effective service and to reduce the amount of traffic along the right-of-ways. DMUs are conventional passenger coaches equipped with diesel engines.

Summary of Results

The analysis results for each route are shown in **Table E-1** and summarized below:

Attleboro Compared to the 1995 Feasibility Study, ridership is somewhat reduced and costs have increased. Daily inbound boardings would be 3,230 (versus the 3,940 projected in 1995) because of a slight reduction of capacity on the Northeast Corridor. Cost increases can be attributed to the need for double track and grade separation on the bypass; replacement rather than upgrade of track; and more advanced signal requirements. Total project cost is estimated to be about \$407 million, including equipment, design, land acquisition and contingencies.

Stoughton This route would have the highest ridership, with 4,325 inbound boardings. Total project cost is estimated to be \$410 million, or in the same range as Attleboro. The Stoughton right-of-way passes through the Hockomock Swamp Area of Critical Environmental Concern in Raynham. Extension via this route would require special project designation by the Executive Office of Environmental Affairs (EOEA) and would be difficult to permit.

Middleborough Four alternatives were considered. The alternatives that offer the highest levels of service attract about 2,045 riders. Ridership on Middleborough extensions is lower mainly because Back Bay station, where 40 percent of southside

MBTA riders disembark, is not served. More importantly, there are several operational issues which diminish the feasibility of an extension along this alignment.

Middleborough options that simply extend Old Colony service (2A, 2C and 2C-1) would not be able to accommodate both New Bedford/Fall River and Old Colony passengers. The addition of New Bedford/Fall River passengers onto Old Colony trains would require some trains to carry 27 percent more passengers than their seating capacity. Additional trains would need to be run to accommodate all passengers.

The concept of adding New Bedford and Fall River trains to the Old Colony system was tested under Alternative 2B. The results show that the 9.8 mile segment of single-track north of Braintree results in a highly constrained operating environment and effectively precludes the addition of New Bedford/Fall River service. Simulations have demonstrated that increased train traffic would have significant impacts on the level of service provided to Old Colony passengers. Minor delays would have the potential to dead-lock service throughout the entire Old Colony system affecting the daily commute for more than 15,000 south shore commuters.

To overcome Old Colony capacity constraints and to add service for New Bedford/Fall River passengers, the MBTA would need to double track the Old Colony line north of Braintree. This would add \$100 million in capital costs and an undetermined, yet likely significant, amount for property acquisition and relocation. This investment would have a minimal impact on New Bedford/Fall River ridership, but would make this alignment the most expensive to construct, with total project costs exceeding \$436 million.

DMU Options The feasibility and cost-effectiveness of diesel multiple unit (DMU) operations are inhibited by current federal safety regulations. Current requirements dictate a 7 to 12 minute delay for passengers on trains that would "couple" together at East Taunton station. The use of DMU technology to serve as shuttles between Fall River, Taunton and New Bedford would be, however, a relatively cost-effective means of augmenting branch service where main line capacity is constrained.

Enhanced Commuter Bus This alternative would increase bus headways, expand commuter parking, and provide bus passengers with the same fare and transfer benefits as rail passengers. Because bus travel times are generally equal or better to commuter rail travel times, ridership would be relatively high. An estimated 3,500 commuters would use this improved service, an increase of about 2,050 daily. Total project costs would be \$22 million. Analysis shows that the increase in fare revenues from these changes would exceed the incremental cost in bus operations.

TABLE E-1
Summary of Alternatives (\$1996)

Alt. No.	Description	Daily Inbound Boardings	Total Project Cost ¹
1A	NB/FR via Attleboro	3,230	\$407 m.
1B	NB/FR via Attleboro - DMU Service	2,970	\$406 m.
2A	NB/FR via Middleborough	1,320	\$293 m.
2B	NB/FR via Middleborough - Skip Stop, Shuttle/Transfer	2,045	\$436 m. ²
2C	NB/FR via Middleborough - Relocated Lakeville Station	1,410	\$305 m.
2C-1	NB/FR via Middleborough - Relocated Lakeville Station, Shuttle/Transfer	2,030	\$309 m.
3A	NB/FR via Stoughton	4,325	\$410 m.
3B	NB/FR via Stoughton - DMU Service	3,890	\$421 m.
4	Enhanced Bus Service	3,500	\$22 m.

1. Total Project Costs = Infrastructure, Equipment, Land Acquisition, Engineering/Design and Contingencies.
2. Total Project Costs for Alternative 2B do not include land acquisition and relocation north of Braintree.

Conclusions

The Stoughton route would attract the highest ridership and represents the most cost-effective commuter rail alternative. The attractiveness of this route is due mainly to the ability to serve a new North Easton station where more than 1,000 passengers would board daily. However, the presence of an Area of Critical Environmental Concern would make this alternative difficult to permit. The Attleboro route attracts slightly less ridership than the Stoughton route, yet would be preferable from an environmental perspective.

Extensions of Old Colony service from Middleborough would not be feasible without increasing train traffic on the tightly constrained Main Line north of Braintree. The scheduling of additional trains along this 9.8 mile segment of single-track would have significant operational impacts on all branches of the Old Colony system. Simulations have shown that virtually all peak-period service would be delayed, and potentially deadlocked.

The construction of a second track north of Braintree would make this route a feasible alternative, but it would not bring Fall River/New Bedford ridership up to the levels projected along the Attleboro or Stoughton routes. Furthermore, the costs associated with double tracking would make an extension via Middleborough the most expensive and least cost-effective option. The complexity of double tracking along this densely developed corridor, and the potential magnitude of residential and business relocations in Quincy and Dorchester, cannot be overstated.

The Attleboro and Stoughton routes are the only options that would attract ridership levels that are comparable to those found on existing MBTA commuter rail lines. This expanded alternatives evaluation attempted to generate increased ridership along the Middleborough route by adding more trains to the Old Colony system, running supplemental shuttle service for New Bedford and Fall River passengers, and considering the relocation of Middleborough/Lakeville station. These approaches resulted in Middleborough line alternatives with ridership levels that were still 35 to 50 percent less than found on the Attleboro or Stoughton routes.

**NEW BEDFORD / FALL RIVER COMMUTER RAIL EXTENSIONS
EXPANDED ALTERNATIVES ANALYSIS**

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I. INTRODUCTION

A. BACKGROUND

Until 1958, commuter rail service from South Station to New Bedford and Fall River was operated via Canton, Stoughton and Taunton. Current MBTA service along this route now operates only as far as Stoughton. Additional service to southeastern Massachusetts is also provided to Providence, via Attleboro (see **Figure 1**). Commuter rail service along the Old Colony lines to Middleborough and Plymouth will be restored in September 1997. The remainder of Southeastern Massachusetts is served by three major bus carriers.

This report evaluates the feasibility of reestablishing passenger train service between New Bedford, Fall River, Taunton and Boston as a way of mitigating against traffic congestion and improving access to Boston.

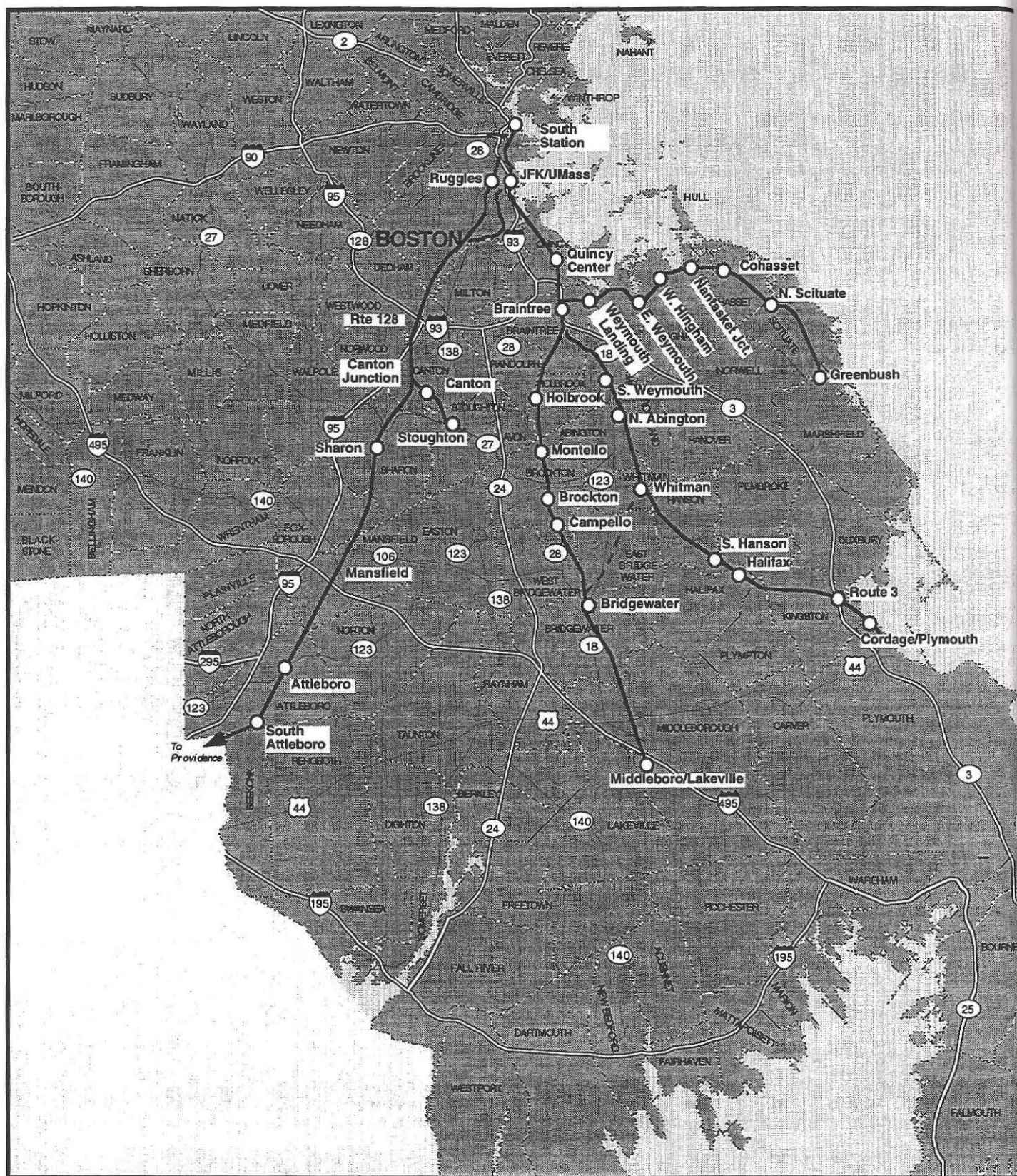
B. PREVIOUS STUDIES

In January 1990, MBTA published a study entitled *Commuter Rail Extension Feasibility Study - New Bedford/Fall River* (Louis Berger & Associates). The study recommended that service on the Stoughton Branch be extended to New Bedford and Fall River. However, prior to the MBTA's commencement of design and environmental analysis of the extension, a number of issues were raised by the Joint Transportation Planning Group (JTPG) of the Southeastern Massachusetts Metropolitan Planning Organization. These concerns resulted in the identification of several alternatives that had not been previously considered, or that required additional review.

In response to the JTPG, the MBTA completed an *Expanded Feasibility Study* in May, 1995. The following alternatives were considered:

- Four alternatives extending the Old Colony Middleborough Line to either Fall River or New Bedford, but not both;
- Two alternatives extending the Stoughton Branch to either North Easton or to both Fall River and New Bedford;
- One alternative branching from the Northeast Corridor Main Line (NEC) in Attleboro to both Fall River and New Bedford, and;
- Enhanced commuter bus service.

Figure 1
Existing and Planned MBTA Commuter Rail Services in Southeastern Massachusetts



The report found that, while construction costs for the Middleborough alternatives would be reasonable, ridership would be lower than all other alternatives due to longer travel times and the inability to stop at Boston's Back Bay Station. Furthermore, due to capacity constraints on the Old Colony system, it was assumed that service to both New Bedford and Fall River could not be provided without sacrificing desired service levels. The Stoughton alignment had the highest ridership, but also the highest cost.

Following a series of public presentations, the Attleboro alignment was selected as the preferred alternative because it was viewed as having the best balance of cost and benefits. It had high ridership, reasonable capital costs and travel times competitive with automobile trips. It was also viewed as having lower environmental and community impacts than a Stoughton alignment.

In September 1995, the MBTA initiated engineering studies to construct an extension of commuter rail service to the cities of Taunton, New Bedford and Fall River. This extension was proposed to be constructed as a branch from the existing MBTA Attleboro Line, to use the Attleboro Secondary track through Norton and Taunton, and to branch south of Taunton to provide full service to both New Bedford and Fall River. The service would have made use of existing and active railroad right-of-ways, with the exception of a new 2-1/2 mile bypass along a utility right-of-way in Attleboro.

The MBTA submitted an Environmental Notification Form for the Attleboro alignment in October 1995. This submission raised a number of local concerns regarding the construction of a 2 1/2-mile bypass along new right-of-way in Attleboro and regarding increased levels of train traffic through Norton and at grade crossings in Taunton. These concerns were also expressed by state legislators and at a number of local community meetings held by the MBTA. In response, the MBTA stopped work on the project in January 1996.

C. 1996 LEGISLATIVE DIRECTIVE

In August 1996, the State Legislature adopted the 1996 Transportation Bond Bill and called for the MBTA to further study all viable alternatives for extending commuter rail service to both New Bedford and Fall River. This report is prepared in response to the legislative directive (Chapter 205, Section 2J), and includes the cost, projected ridership and proposed operational scenario for each alternative, as well as an assessment of potential environmental impacts, grade crossings and other public safety considerations.

The objective of this report is to present a more detailed examination of the feasible alternatives and to assist state legislators, the affected communities and the MBTA in achieving consensus on a preferred route for commuter rail service.

This report focuses primarily on the three alternative routes running as far south as Cotley Junction in Taunton. From Taunton to New Bedford and Fall River there are not any significant differences between the alternatives. Nine different alternatives are evaluated in this report: two via Attleboro, four via Middleborough, two via Stoughton, and a commuter bus option.

Alternatives 1A and 3A are similar to options studied in the 1995 Feasibility Study.

Alternatives 1B and 3B consider the use of diesel multiple unit (DMU) vehicle technology.

Alternative 2A represents an extension of Old Colony Middleborough service, with alternating trains between the two terminals. To reduce the travel time via Middleborough, Alternatives 2C and 2C-1 consider relocating the Old Colony Middleborough/Lakeville terminal that is now under construction. Also, to provide additional service on the tightly constrained Old Colony system, Alternatives 2B and 2C-1 evaluate the use of more innovative operating plans.

All alternatives would include stations at New Bedford, Fall River, Freetown and East Taunton. Attleboro routed service would also include a station at Taunton Center. Stoughton service would include new stations at Dean Street/Taunton, Raynham and North Easton. For the Middleborough alternatives, an alternative East Taunton station was located off of Stevenson Street and an alternative Middleborough/Lakeville station was located near Routes 18 and 79.

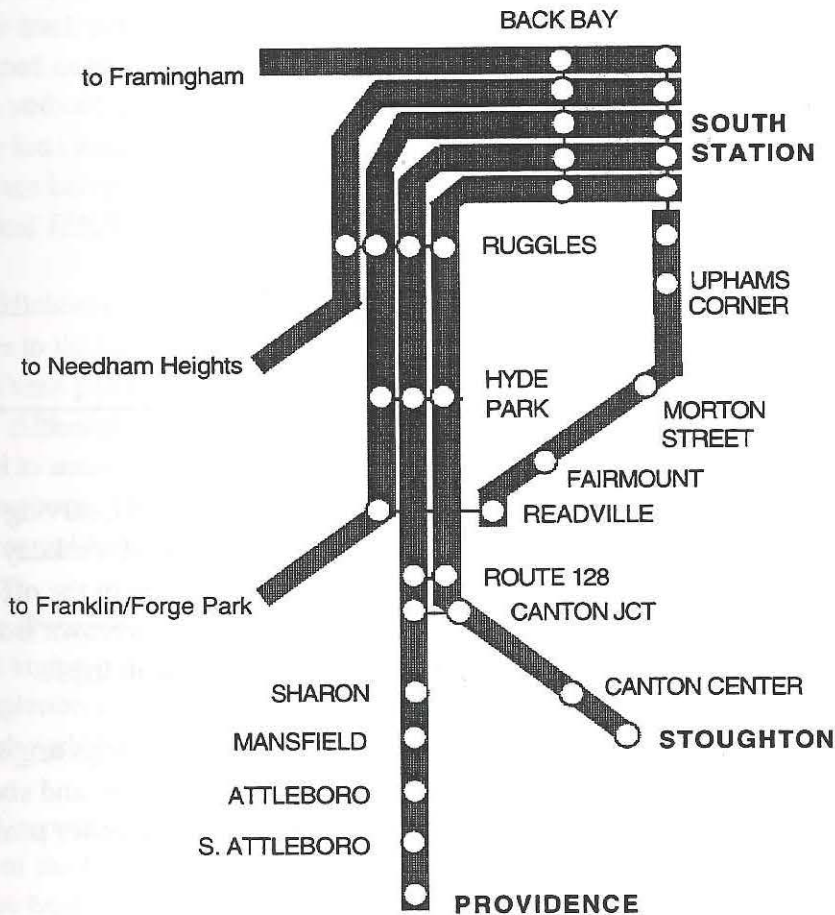
II. ALTERNATIVES CONSIDERED

A. SUMMARY OF EXISTING CONDITIONS

Existing Transit Services in the Study Area

Passenger rail service in the study area is currently provided from South Station only as far as Stoughton via the Stoughton Branch and to Providence, Rhode Island, via Attleboro. These services are shown in Figure 2.

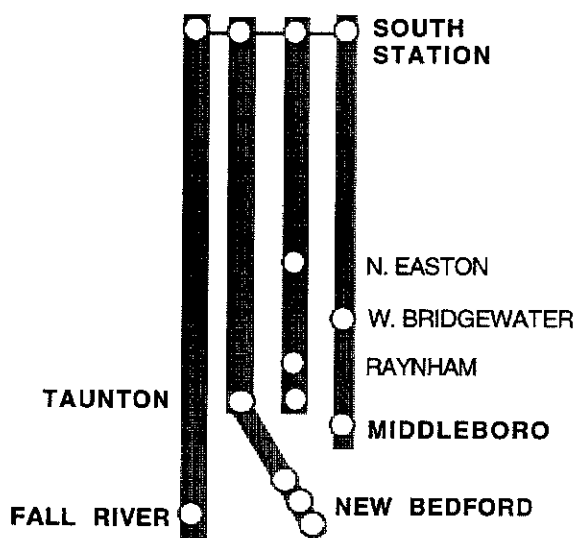
FIGURE 2
Existing MBTA Commuter Rail Service from South Station



The remainder of southeastern Massachusetts is serviced by three major bus carriers. Current bus routes between the study area and downtown Boston are shown in Figure 3. Of the communities being considered for new commuter rail stations, only Freetown is not currently served by commuter bus service to Boston.

FIGURE 3

Existing Commuter Bus Service in Southeastern Massachusetts



American Eagle Motor Coach operates a route between New Bedford and Boston, serving several intermediate park & ride facilities. This route runs 16 inbound and 17 outbound weekday trips. Headways range from 15 to 40 minutes in the peak period, and about two hours in the off-peak. The scheduled running time inbound between downtown New Bedford and downtown Boston is 1 hour, 45 minutes on most peak trips, and 1 hour, 30 minutes on most off-peak trips.

Bonanza Bus Lines operates a route from Fall River to South Station with most trips originating from Newport, Rhode Island. At present, there are eight round trips on weekdays, and six on Saturdays and Sundays. The scheduled inbound running time is 1 hour, 5 minutes for peak trips, and 1 hour for off-peak trips.

Bloom's Bus Lines, Inc. operates a route from Taunton to Boston, also serving parts of Raynham and Easton. At present, 16 inbound and 15 outbound trips are run on weekdays. The scheduled running time inbound is generally 1 hour 10 minutes during the peak period. Middleborough

buses are operated by Interstate Coach. These trips serve the Bridgewater, Middleborough, Stoughton, Easton and Boston.

Planned or Proposed Transportation Services in the Service Area

Several transportation improvement projects that may benefit commuters in the greater New Bedford/Fall River area are currently under construction or planned as part of the region's long range transportation planning process.

Old Colony Commuter Rail Project

The Old Colony Commuter Rail Project involves the restoration of commuter rail service on the Middleborough, Plymouth and Greenbush Lines. The Middleborough and Plymouth lines are now under construction and will be operational in September of 1997. The Supplemental Final EIR report and preliminary engineering plans are now being prepared for the Greenbush line.

All three Old Colony lines merge in Braintree and proceed north to South Station on a shared 9.8 mile one-track system known as the Main Line. The Main Line has two passing tracks, constructed as part of the Old Colony, project to maximize capacity to the greatest extent possible without incurring an estimated \$100 million in costs for double tracking and further costs for land acquisition and relocation. Since the last feasibility study, two new commuter rail stations are being incorporated into the Old Colony system along the Main Line at Quincy Center and JFK/UMass.

The Middleborough Line extends for approximately 25 miles, serving seven stations, from Braintree to the Middleborough/Lakeville terminal. The Line is single track with four passing tracks. These passing tracks have been located to optimize operations on the Old Colony system. Although the service plan for the year 2000 assumes six-car trains, platforms have been designed to accommodate nine-car trains. The Middleborough/Lakeville station is located about one-mile south of the Middleborough Wye/Middleborough Secondary junction where trains to Fall River and New Bedford would diverge to the west.

Highway Improvements

Planned highway improvement projects include the Central Artery/Third Harbor Tunnel project, the completion of Route 44 improvements, the widening of Route 128 (I-93/I-95) between Randolph and Wellesley, and the widening of Route 3 between Weymouth and Duxbury.

MBTA Commuter Parking Expansion Program

As part of the Central Artery Mitigation Program, it is required that 20,000 commuter parking spaces be built between 1991 and 1999. Planned expansions in southeastern Massachusetts include additional commuter parking in Quincy, South Attleboro, Mansfield, Sharon, Walpole, Norwood and Route 128 as well as the new spaces being developed as part of the Old Colony project.

Proposed Commuter Rail Service to Bourne

In September 1996, the MBTA completed a study which considered the feasibility of extending Middleborough Line trains further south along existing trackage to the Cape. Amtrak currently uses this route via Attleboro, for summer service to the Cape. Capacity constraints that would limit the routing of both New Bedford/Fall River and Bourne trains through Middleborough are discussed later in this report.

B. DEFINITION OF ALTERNATIVES

This expanded alternatives analysis is prepared in response to a legislative directive that specified that the feasibility of the Middleborough, Attleboro and Stoughton alignments be re-examined. Several operational plans were considered for each of these routes. In addition, the enhanced commuter bus alternative is updated and refined for comparison purposes. It is important to note that, although much of Fall River and New Bedford rail service would operate as one line, there would be two outlying branches. It is not possible to effectively serve both cities with one line, unless diesel multiple unit technology or cross platform transfers are utilized.

The No-Build alternative constitutes the baseline representing no action and against which all the other alternatives are evaluated. Furthermore, all rail alternatives assume that existing commuter bus service will remain as currently operated and Old Colony commuter rail service will operate as currently planned and permitted.

Alternative station sites were not evaluated unless station location had a direct effect on operational feasibility. This was the case for two stations along the Middleborough alignment in East Taunton and Lakeville, and for a relocated Taunton station along the Stoughton alignment. Site evaluation criteria for station siting includes: highway access, railroad operations, environmental issues, consistency with community objectives, cost and constructibility.

No-Build Alternative

The No-Build alternative constitutes the baseline against which all the other alternatives are evaluated. This alternative includes existing transportation facilities and services, as well as committed facilities and services that will be completed by the year 2010. Assumptions include completion of the Central Artery/Tunnel project, completion of Route 44, Route 128 widening between Routes 24 and 9, Route 3 widening between Weymouth and Duxbury, an additional 2,700 parking spaces along the Attleboro and Franklin commuter rail lines, an additional 1,300 spaces at the Quincy Adams Red Line station, an additional 300 spaces at the Hingham commuter boat terminal, construction of additional maintenance and storage facilities. Also included in the committed services are implementation of service along the three Old Colony commuter rail lines and completion of the South Boston Piers Transitway project. The model

assumes a ten-minute travel time savings for High Occupancy Vehicles (HOV's) using the HOV lane on the Southeast Expressway.

Alternative 1A: New Bedford and Fall River via the Attleboro Line **Alternating Standard Train Consists**

This alternative was studied in detail as part of an Environmental Notification Form submitted to the Executive Office of Environmental Affairs in October, 1995 (see **Figure 4**). It would follow the MBTA Attleboro Shore Line from South Station to a point just north of Attleboro station. A 2 1/2-mile double track bypass would be constructed along a power line right-of-way in northeast Attleboro to connect with the Attleboro Secondary heading towards Taunton. The service would travel through Norton, Taunton Center and Cotley Junction, diverging at Myricks Junction in Berkley. One branch would continue to New Bedford along the New Bedford Secondary. The second branch would use the Newport Secondary to serve Freetown and Fall River. The total extension would be about 42 miles.

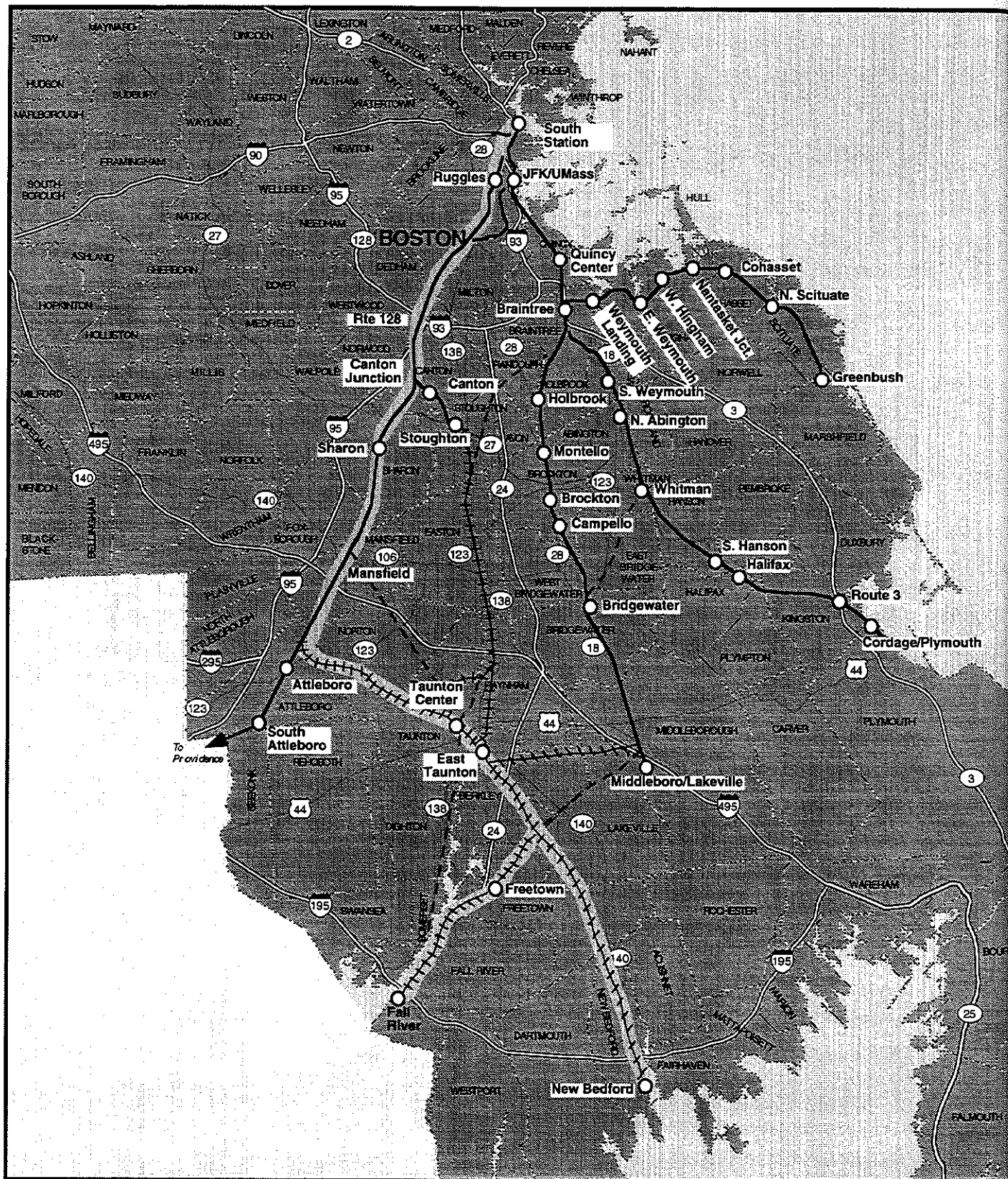
Trains from New Bedford and Fall River would interface with Attleboro/Providence trains and Amtrak high-speed inter-city trains between Attleboro and South Station. Track conditions and capacity along the Attleboro Main Line were assumed to be consistent with Amtrak's Northeast Corridor (NEC) Master Plan. Track capacity in the corridor was evaluated in detail as part of this study. This analysis concluded that additional capacity in the range of 36 trains daily was available for New Bedford and Fall River service.

Freight service now operates along the Attleboro, New Bedford and Newport Secondaries. Track replacement would be required along the Attleboro Secondary to increase speeds and improve grade crossings. South of Cotley Junction, complete rebuilding of the New Bedford and Newport Secondary Tracks would also be required. A double track connection is required at the Attleboro bypass to enable the smooth transition of trains on and off the Northeast Corridor.

Service to both New Bedford and Fall River would be operated in addition to the existing service on the Attleboro Line (see **Figure 5**) and would replace Attleboro line stops at Sharon. All New Bedford/Fall River trains would stop at East Taunton, Taunton Center, and Sharon. The East Taunton station would be a major park-and-ride facility, located just northwest of Cotley Junction and the intersection of Routes 24/140. Trains from Fall River would also stop at Freetown. From Sharon, the trains would run express to Ruggles Station, then serve Back Bay and South Station. Providence trains would skip the Sharon stop.

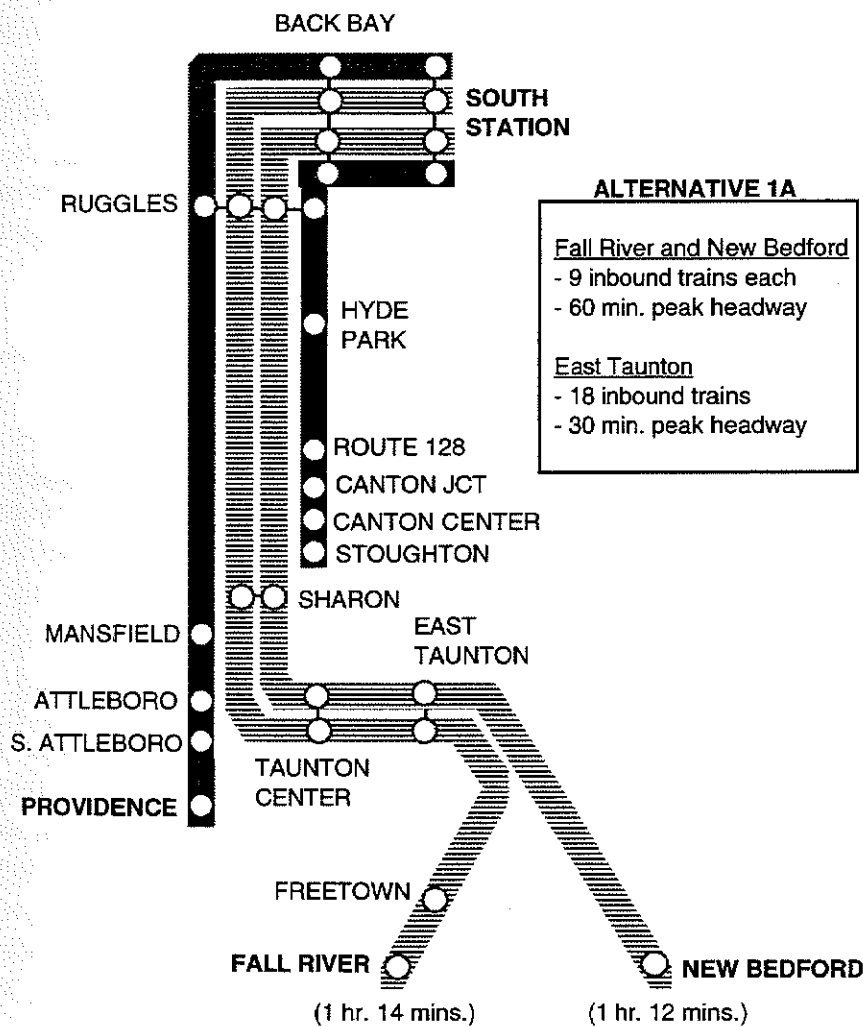
Eighteen daily trains would serve each terminal. Travel time from Fall River to South Station would be 1 hour and 14 minutes and from New Bedford would be 1 hour and 12 minutes. Service would be provided from each city every 60 minutes during the peak periods.

Figure 4
Commuter Rail Service to New Bedford and Fall River via Attleboro
Alternatives 1A and 1B



This alternative is similar to that proposed for implementation in the summer of 1995. The only difference is that, based on a detailed operational analysis, the level of service has been reduced from 22 trains serving each terminal daily to 18 trains.

FIGURE 5
Alternative 1A - New Bedford and Fall River via Attleboro

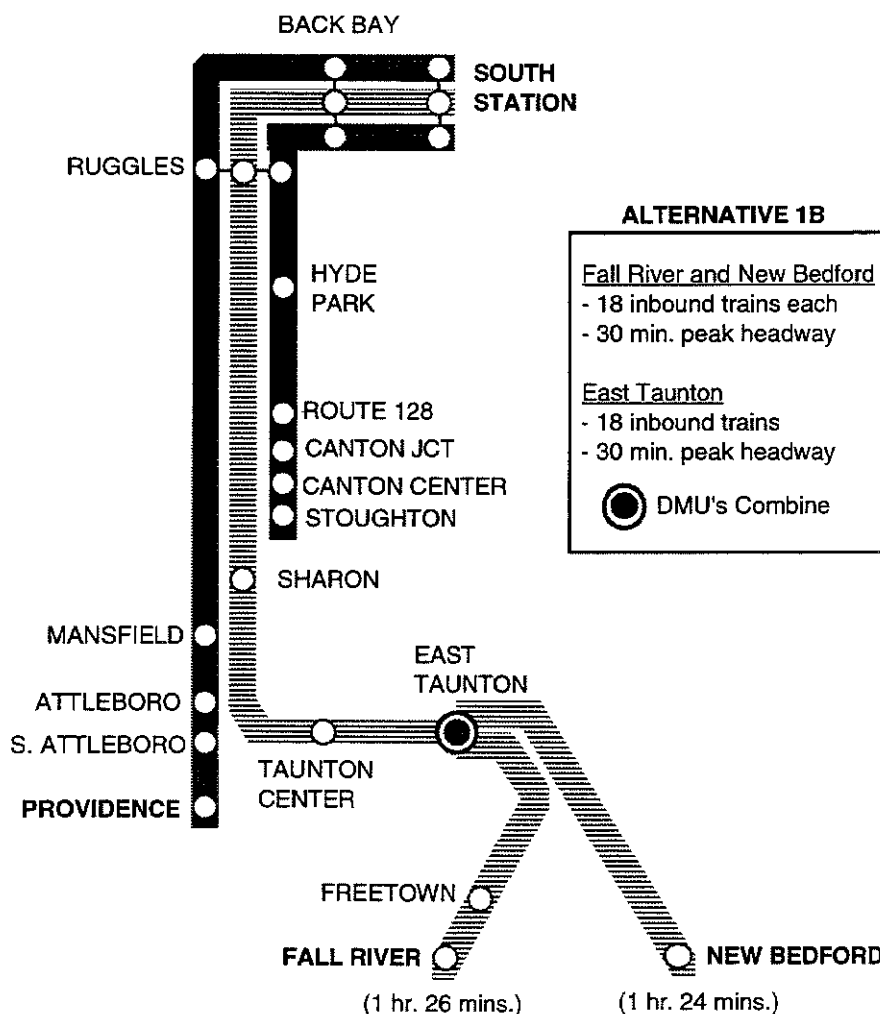


Alternative 1B: New Bedford and Fall River via the Attleboro Line Diesel Multiple Unit (DMU) Service

This alternative would follow the same route as Alternative 1A via Attleboro (see **Figure 6**). However, instead of using the standard train consists that are in now in service throughout the MBTA system (5 to 8 commuter coaches and a diesel locomotive operated in push/pull mode), diesel multiple units (DMUs) would be introduced to the system. DMUs are self-propelled rail cars that can operate in small one or two car pairs, or be coupled with additional cars to make larger consists.

FIGURE 6

Alternative 1B - New Bedford and Fall River via Attleboro - DMU Service



DMU consists from Fall River and New Bedford would meet and couple at East Taunton Station. This ability to join smaller consists into larger trainsets would have the benefit of increasing service to each terminal without increasing train traffic. North of East Taunton the service would be identical to Alternative 1A. The use of DMU cars would provide twice as much service (36 trips per day) to Fall River and New Bedford. Service would be provided from each city every 30 minutes during the peak periods.

Travel times from south of East Taunton would be longer than for Alternative 1A. To facilitate the safe operation of trains in close proximity, DMUs approaching East Taunton and planning to couple would effectively be staggered by five minutes. By alternating the lead DMU consist between Fall River and New Bedford, this five minute delay would only be experienced by passengers on every other trip. After coupling, a seven minute layover would be required to carry out brake testing. This results in a 7 to 12-minute overall added delay. The one way trip time would be approximately 1 hour and 24 minutes for New Bedford, Fall River and Freetown passengers.

Alternative 2A: New Bedford and Fall River via the Middleborough Line Standard Consists

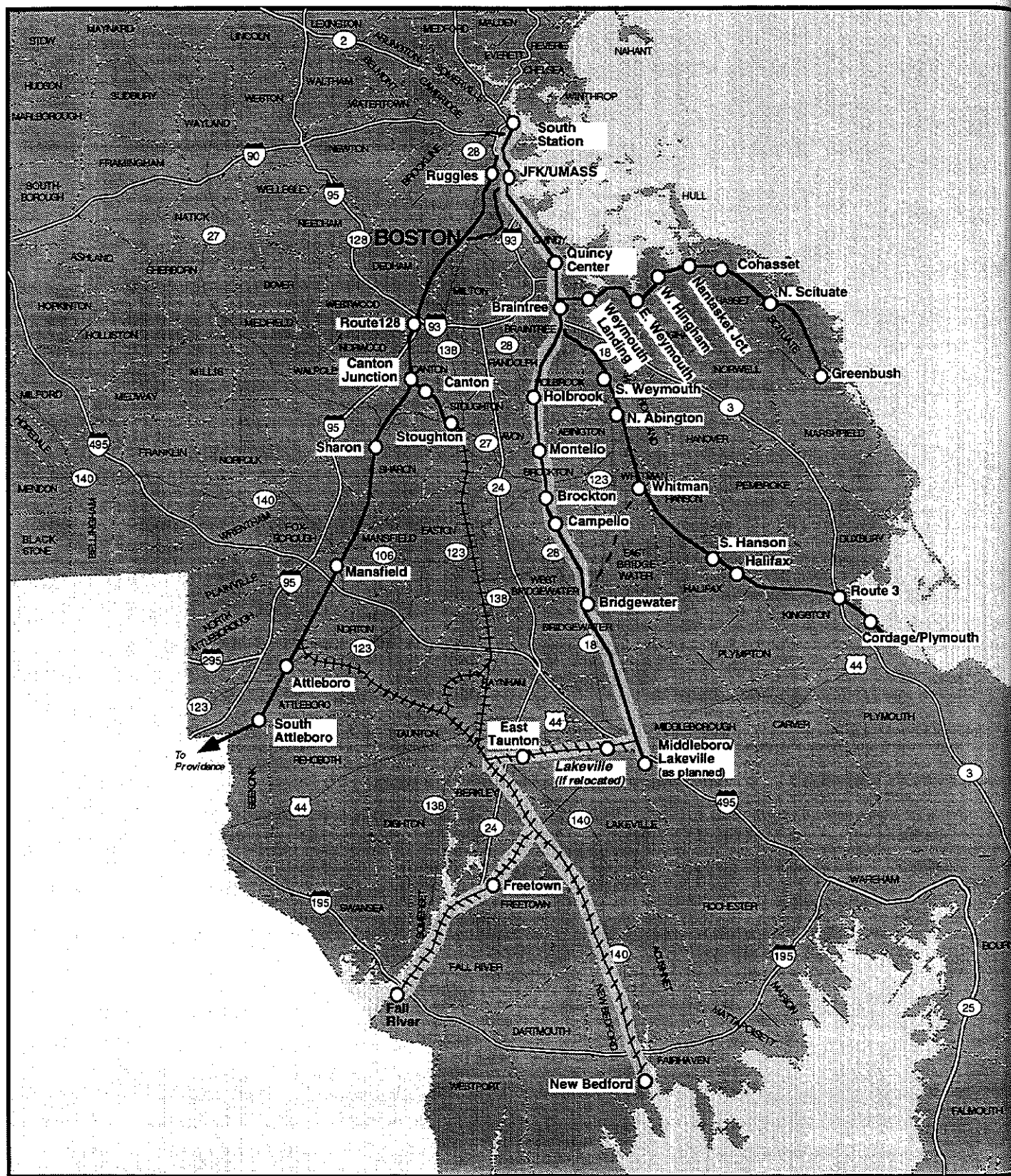
This alternative would be an extension of the Old Colony Middleborough Line. Service would be extended from the planned Old Colony terminus at Middleborough/Lakeville to both New Bedford and Fall River (see **Figure 7**). The service would branch from the Old Colony Line and would follow the Middleborough Secondary track to East Taunton and Cotley Junction. South of East Taunton, service would follow the same alignment as the Attleboro route.

As part of the Old Colony project, Middleborough/Lakeville Station is being constructed about one mile south of the junction of the Middleborough Secondary. This alternative assumes that this station would be retained at its present location, and requires New Bedford and Fall River trains to reverse direction and travel northbound before heading west on the Middleborough Secondary. This reverse move would add at least 10 minutes to the overall travel time, due to the longer distance travelled and the need to perform brake tests before changing direction. Relocation of the Middleborough/Lakeville terminal to avoid this time penalty is analyzed under Alternatives 2C and 2C-1.

To avoid a second "reverse move", the East Taunton station would be relocated from its formerly proposed site north of Cotley Junction. Nine sites were evaluated: two along the Middleborough Secondary east of Route 24 in Taunton, two west of Route 24, one at the Silver City Galleria, and four sites south of Cotley Junction in Berkley. For the purposes of this study, the Taunton sites east of Route 24 were considered to provide the best commuter access with the least environmental impact.

Figure 7

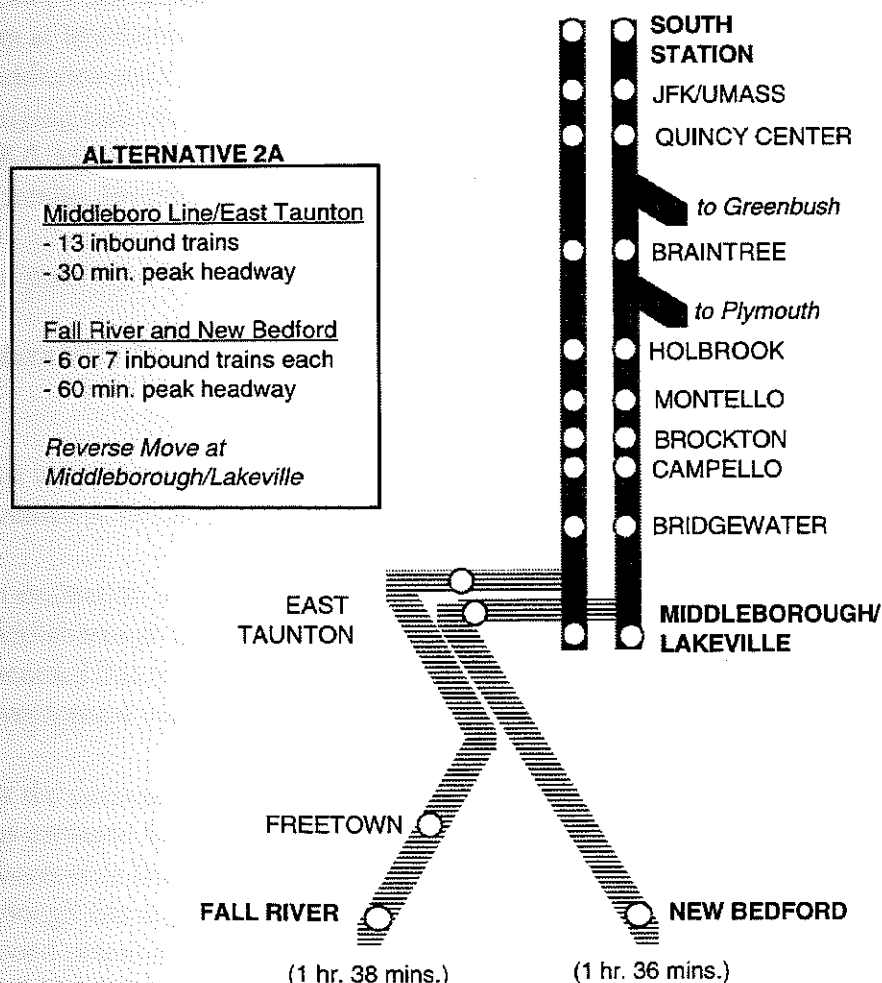
Commuter Rail Service to New Bedford and Fall River via Middleborough
Alternatives 2A, 2B, 2C and 2C1



This alternative would operate as an extension of Old Colony service. Old Colony service from Middleborough/Lakeville would be the same as planned for September, 1997. A total of 26 trains per day would operate (13 to each city), with alternating consists departing Fall River and New Bedford every hour during peak (see **Figure 8**). All trains would service East Taunton. Five peak period trains would be operated between Middleborough/Lakeville and South Station. One reverse peak direction train would operate to provide service to Bridgewater State College and to provide significant cost savings by effectively "recycling" and making two peak period runs. Old Colony service is to South Station only; Back Bay service cannot be provided because the Old Colony line uses right-of-way through Dorchester and South Boston. Total travel time to South Station would be 1 hour and 36 minutes.

FIGURE 8

**Alternative 2A- New Bedford/Fall River via Middleborough
Extension of Old Colony Service - Alternating Standard Consists**



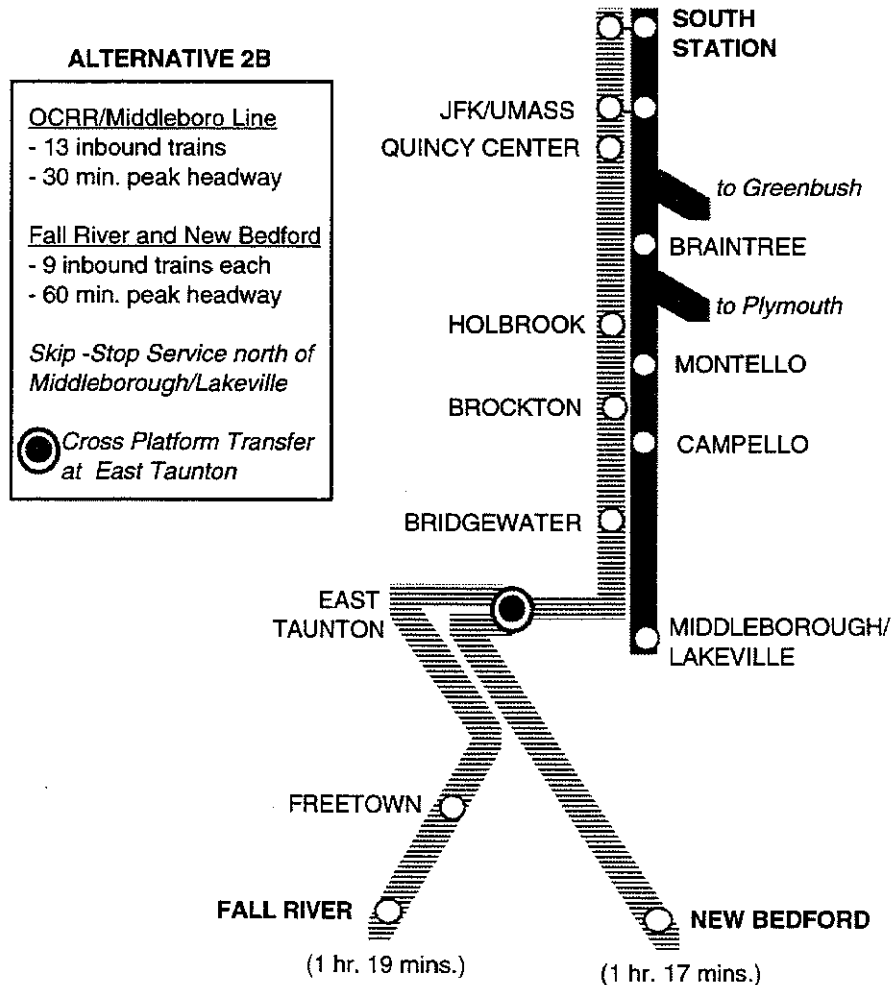
The Middleborough Secondary track is currently used by Conrail freight and Amtrak summer trains. Track reconstruction would be required to increase speeds and improve grade crossings. Small sections of new track would be built at Cotley Junction and at the Middleborough Wye, enabling trains to move off and on the Middleborough Secondary.

**Alternative 2B: New Bedford and Fall River via the Middleborough Line
Skip-Stop Service/Cross Platform Transfer at East Taunton**

Alternative 2B was developed to test the theory that New Bedford/Fall River service could operate "in tandem" with Old Colony Middleborough service, using the same Main Line time slots to reach South Station (see **Figure 9**).

FIGURE 9

**Alternative 2B - New Bedford/Fall River via Middleborough
Skip-Stop Service/Cross Platform Transfer at East Taunton**



Alternative 2B would increase the number of peak period trains to New Bedford and Fall River. The Old Colony Middleborough Line would continue to operate as a separate service, with thirteen daily trains in each direction. An additional nine trains in each direction would be routed to New Bedford or Fall River.

Trains would alternately serve each terminal on an hourly basis in the peak period as described in Alternative 2A. However, a shuttle would also operate between Fall River, East Taunton and New Bedford, providing 30 minute peak period headways to each terminal. Passengers from the shuttle would make a cross-platform transfer at East Taunton, boarding the through-routed Boston-bound train originating from the other terminal. Trip time for the passengers using the shuttle service would be 5 minutes longer than if on a through train, but still shorter than if a reverse move was required at Lakeville. To facilitate the shuttle/transfer process, a second track would be constructed between Myricks and East Taunton Station.

Once on the Middleborough Line, the through-routed New Bedford/Fall River train would not stop at Middleborough/Lakeville station, but would run "skip-stop" (in tandem) with the Middleborough/Lakeville train to Boston. New Bedford/Fall River trains would stop at all outlying stations plus Bridgewater, Brockton, Holbrook/Randolph and Quincy Center and JFK/UMass. Old Colony Middleborough/Lakeville trains would stop at Lakeville, Campello, Montello, Braintree, and JFK/UMass. During off-peak, all trains would make all station stops.

The one way trip time would be approximately 1 hour and 17 minutes.

Alternative 2C: New Bedford and Fall River via the Middleborough Line Relocated Middleborough/Lakeville Station

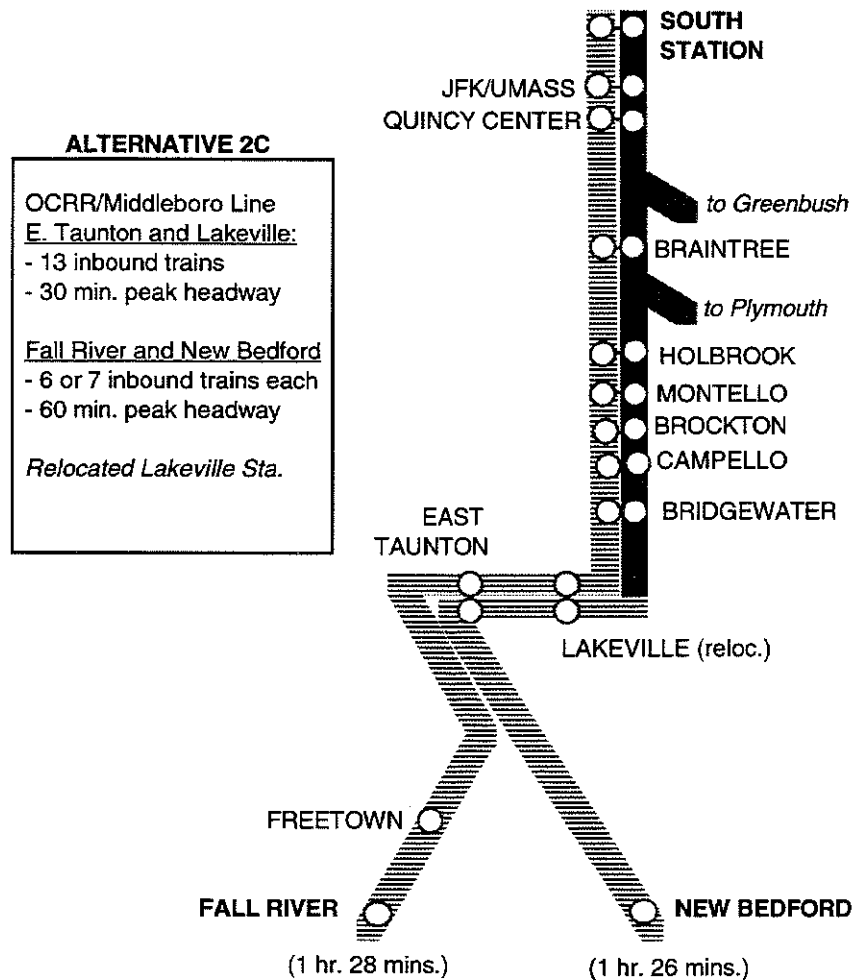
This alternative is identical to Alternative 2A except that the Middleborough/Lakeville Station is assumed to be relocated to avoid the reverse move and reduce the trip time (see **Figure 10**).

An evaluation of potential sites for relocating Lakeville station either north of, or onto, the Middleborough Secondary was performed. Out of six possible sites identified, three were discarded due to either wetland impacts, insufficient land area, poor site access or high development cost.

For the purposes of this study, a potential site in the Great Ponds Industrial Park in Lakeville was assumed for modeling purposes. The site is located on Middleborough Secondary track and is accessible from Routes 79 and 18. The site has no significant environmental constraints, although site access would be more difficult for commuters originating in Middleborough. A second potential site was identified north of downtown Middleborough, although accessibility would be more difficult for Lakeville residents. The existing Conrail Yards are also considered to be a potential site, yet relocation of Conrail operations would make this the most costly option.

FIGURE 10

**Alternative 2C - New Bedford/Fall River via Middleborough
Relocated Lakeville Station/Alternating Consists**

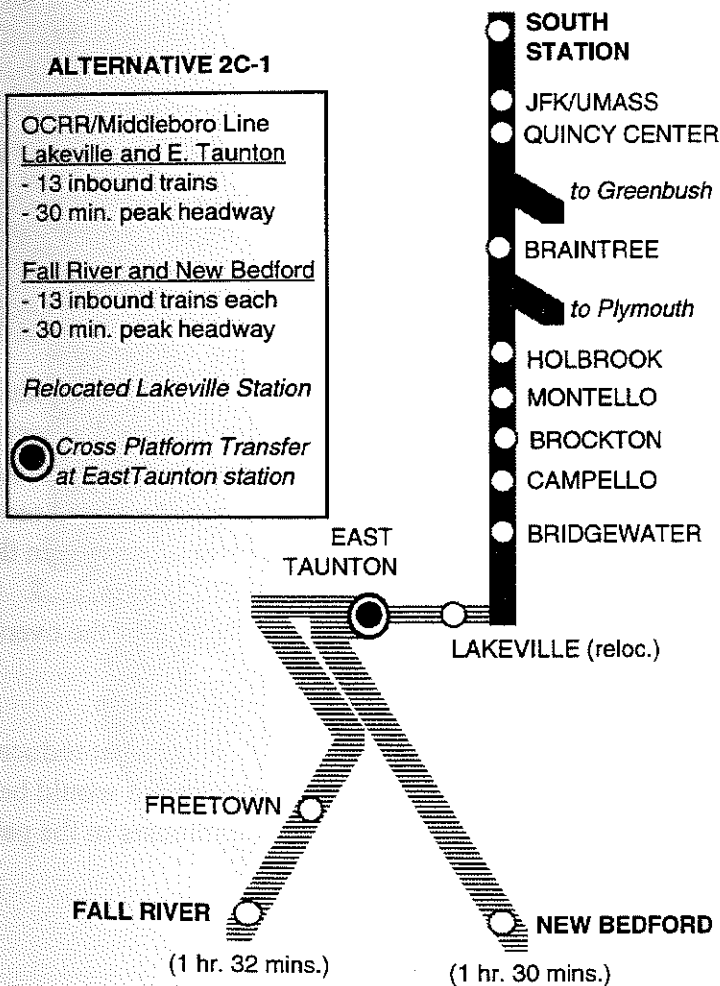


The relocated Lakeville station and the new East Taunton station would be served by 26 trains a day. Fall River and New Bedford would each be served by 13 trains daily. With the elimination of a reverse move, the one way trip time would be about 1 hour and 26 minutes.

Alternative 2C-1: New Bedford and Fall River via the Middleborough Line
New Lakeville Station, Cross Platform Transfer in East Taunton

This alternative is similar to Alternative 2C, however it increases service frequency by adding a shuttle train between terminals and East Taunton station. Peak period trains would alternately operate as through trains to Fall River and New Bedford. An opposing shuttle service would bring passengers to East Taunton to make a cross-platform transfer to the Boston-bound through train (see Figure 11).

FIGURE 11
Alternative 2C1 - New Bedford/Fall River via Middleborough
Relocated Lakeville Station/Cross Platform Transfer



The one-way travel time would be 1 hour 30 minutes, with passengers using the shuttle service experiencing a 5 minute time penalty. There would be 26 trains each weekday to all New Bedford, Fall River and Old Colony stations.

**Alternative 3A: New Bedford and Fall River via the Stoughton Line
Standard Consists**

This alternative would involve an extension of the current Stoughton branch about 46 miles to serve both New Bedford and Fall River (see **Figure 12**). The Stoughton Branch would extend through Weir Junction serving stations in North Easton, Raynham and Taunton. It would then merge onto the Attleboro Secondary where East Taunton station would be located, travel through Cotley Junction, then diverge at Myricks to Fall River and New Bedford.

This alternative differs from the 1995 Feasibility Study in that Taunton Center and its 10 grade crossings are bypassed via Weir Junction instead of Whittendon Junction. A Dean Street station would be constructed in place of Taunton Center.

The railroad right-of-way between Stoughton and Taunton was taken out of service in 1959 and formally abandoned in 1966. Complete track and roadbed reconstruction to meet current MBTA standards would be required for use of this section of the line. Grade separation of the right-of-way would be required at Route 138. South of Cotley Junction, complete rebuilding of the New Bedford and Newport Secondary Tracks would be required as for all alternatives.

Trains would stop at Freetown (Fall River service only), East Taunton, Dean Street, Raynham and North Easton, then run express to Ruggles (see **Figure 13**). The existing Stoughton service would be extended to North Easton and would operate as local service stopping at Stoughton, Canton Junction, Route 128, Hyde Park, and Ruggles. All Stoughton line stations would receive the same level of service as today. This operating plan represents a high level of service in that New Bedford/ Fall River passengers could receive express service from North Easton. Consolidation of New Bedford, Fall River and local Stoughton service would reduce the overall operations costs of this alternative.

New Bedford and Fall River would be served by 17 trains per day. This is somewhat reduced from the 22 trains considered in the 1995 study. Total travel time to South Station would be 1 hour and 13 minutes. Service from both cities would be provided every 60 minutes in the peak periods.

re 12
muter Rail Service to New Bedford and Fall River via Stoughton
natives 3A and 3B

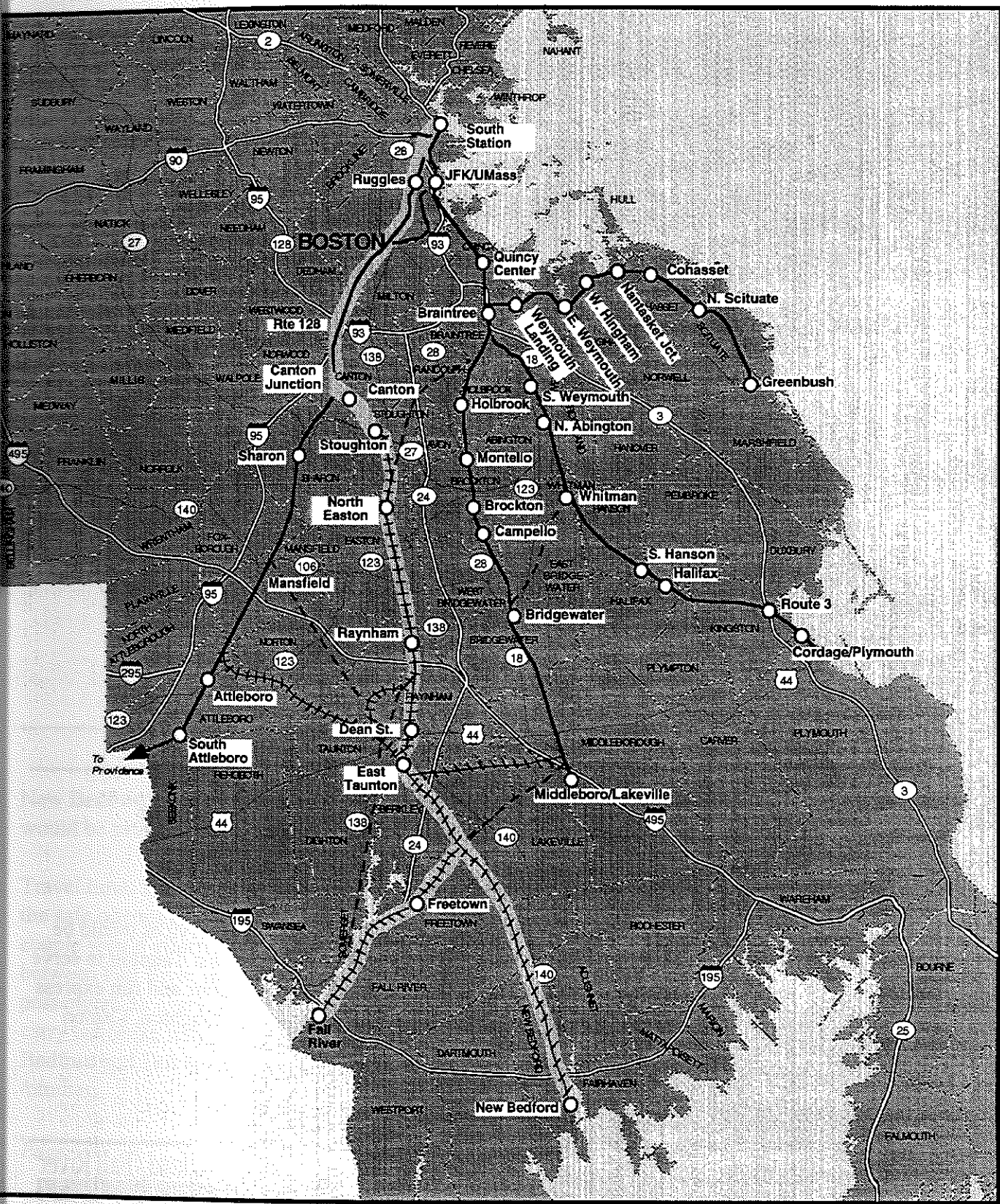
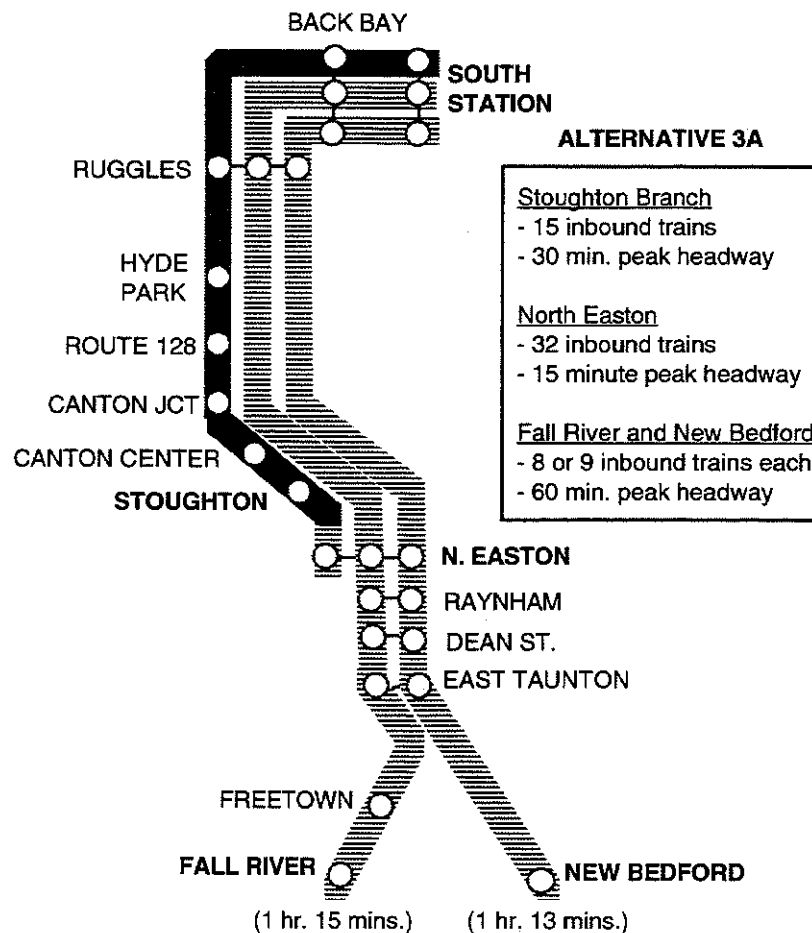


FIGURE 13

**Alternative 3A - New Bedford and Fall River to South Station via Stoughton
Standard Consists**

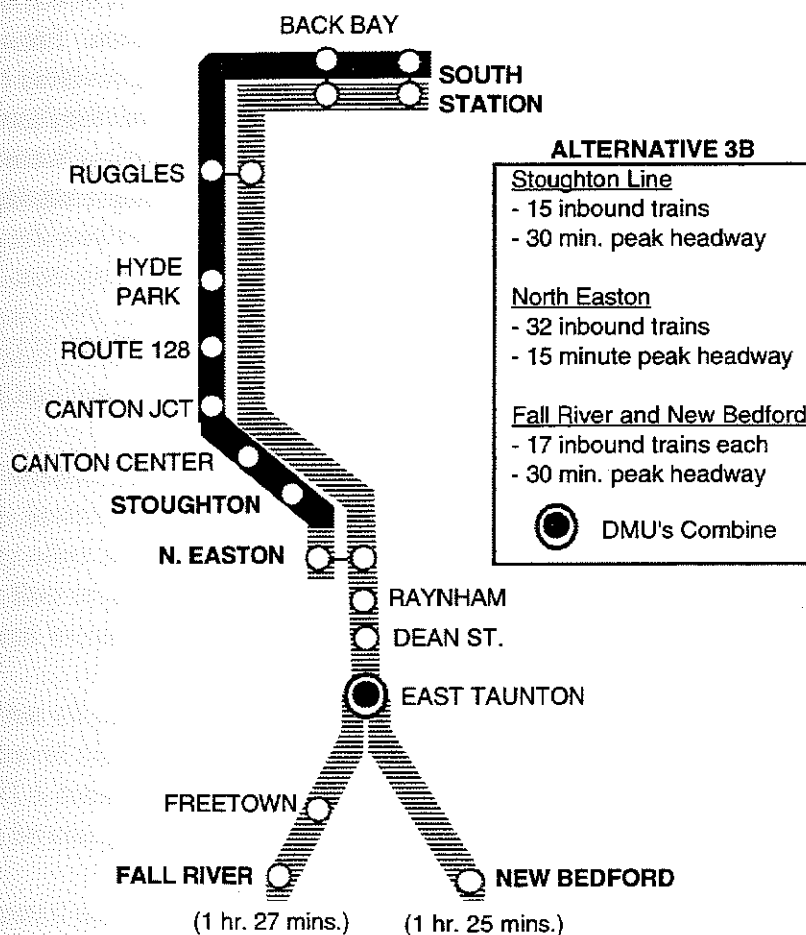


**Alternative 3B: New Bedford and Fall River via the Stoughton Line
DMU Service**

This alternative is similar to Alternative 3A, but New Bedford and Fall River services would be operated using diesel multiple units (DMUs) which would split and join at East Taunton to serve both New Bedford and Fall River. The DMU consists would stop at all stations and run express between North Easton and Ruggles. The North Easton local would stop at Stoughton, Canton Center, Canton Junction, Route 128, Hyde Park and Ruggles (see Figure 14)

FIGURE 14

**Alternative 3B - New Bedford and Fall River to South Station via Stoughton
DMU Service**



New Bedford and Fall River would be served by 34 trains per day. Service from both cities would be provided every 30 minutes in the peak periods.

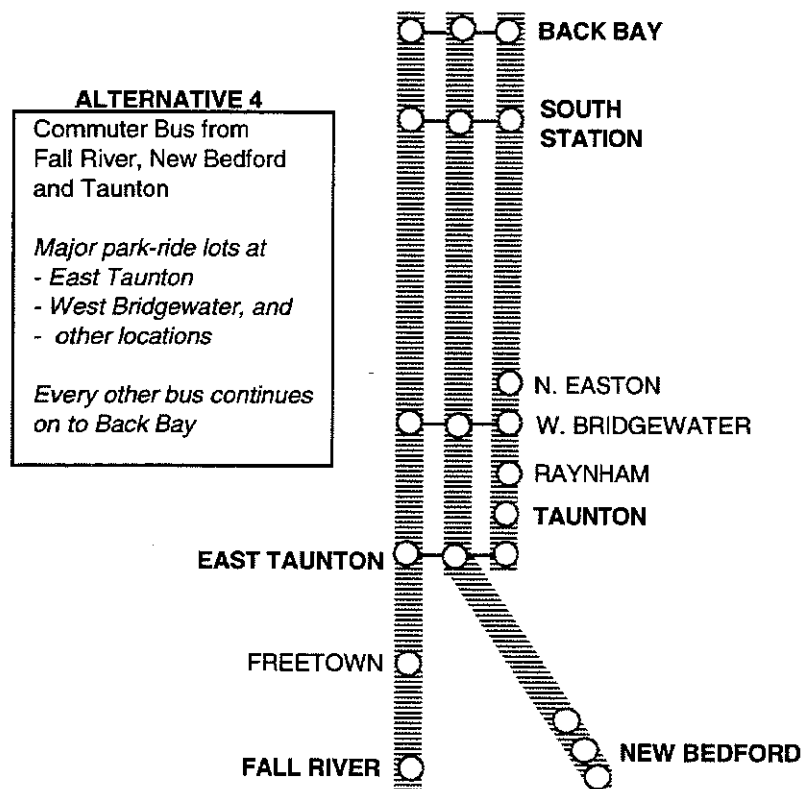
Travel times from south of East Taunton would be longer than for Alternative 3A. To facilitate the safe operation of trains in close proximity, DMUs approaching East Taunton and planning to couple would effectively be staggered by five minutes. By alternating the lead DMU consist between Fall River and New Bedford, this five minute delay would only be experienced by passengers on every other trip. After coupling, a seven minute layover would be required to carry out brake testing. This results in a 7 to 12-minute overall added delay to service for New Bedford and Fall River passengers. The one way trip time would be approximately 1 hour and 25 minutes.

Alternative 4: Enhanced Commuter Bus

This alternative is designed to enhance the attractiveness of existing commuter bus service, assuming no rail extension is built. It includes operational and capital improvements to the existing bus routes between Taunton, Fall River, New Bedford and Boston. Enhancements vary by route, but include frequency improvements, better distribution and provision of park-and-ride lots. Services would be slightly modified in terms of their routing so that they have similar stopping patterns as the rail alternatives (see Figure 15). No improvements were considered for the existing Middleborough to Boston bus service due to the planned implementation of commuter rail service along the Old Colony Line in 1997.

FIGURE 15

Alternative 4 - Enhanced Commuter Bus Service



Bus service from Fall River would be increased from its current 25 minute headways to 15 minute headways. This service would run express to Boston with one additional stop at Freetown. The frequency of Taunton and New Bedford bus services would remain unchanged.

The Taunton service would have two stops in Taunton, one stop in Raynham and one stop in North Easton. The service from downtown New Bedford would make three stops in New Bedford, one south of Route 6, one north of Route 6, one north of I-195, as well as a Taunton stop at Routes 24/140.

All routes would service a park-and-ride facility at Routes 24/106 in West Bridgewater. Additional park-and-ride lots would be constructed where such facilities are not currently available and where the deficit would detract from potential ridership. As suggested by the Southeastern Regional Planning and Economic Development District (SERPEDD), the construction of park-and-ride lots directly off highway facilities would offer greater travel time savings for bus passengers. Buses would access these restricted facilities much like existing highway rest areas, with commuter access from the local road system. Access to commuter lots would be from local roads. These facilities would need to be constructed in cooperation with the Mass Highway Department.

To handle the additional number of buses resulting from this alternative some new terminal capacity at South Station must be provided. Also, to help reduce South Station layover constraints, every other arriving bus would continue onto Back Bay Station. The station/layover capacity at Back Bay requires additional evaluation. Identification of a remote layover facility in the downtown area would help minimize operations costs.

It was assumed that all buses would use the new HOV lane on the Southeast Expressway/I-93 for a 10 minute travel time savings. It was also assumed free transfers could be made from the buses to the MBTA transit system in order to provide better downtown distribution. Bus fares were assumed to be comparable with commuter rail fares.

It has been suggested that the construction of a second HOV facility on Route 24 south of I-93/Route 128 would facilitate commuter bus operations. The construction of a fourth travel lane on Route 128 would alleviate much of the congestion at the present Route 24/I-93 merge. This fourth lane is a base assumption in the evaluation of all future year alternatives.

Other Alternatives Considered

Service via Attleboro Station would avoid the need for a bypass track, but would necessitate a reverse move on the Northeast Corridor. This would create significant operational constraints for both the MBTA and Amtrak and would require that New Bedford/Fall River service levels be substantially reduced.

Two additional Middleborough line options were dismissed early in the process. The first would involve shuttling Old Colony passengers between Middleborough/Lakeville and Bridgewater. This would eliminate the need for New Bedford/Fall River passengers to make a reverse move at Middleborough/Lakeville. However, this was considered contrary to the base assumption that

Old Colony service levels and service quality should be maintained at levels equivalent to that planned today.

A second method of avoiding the reverse move at Middleborough/Lakeville would involve DMU technology. New Bedford/Fall River DMUs could couple together at East Taunton, then travel to Bridgewater to couple with DMUs originating in Lakeville. This option was dismissed due to capacity constraints in carrying all New Bedford, Fall River and Old Colony passengers on one train and due to the time penalties involved with coupling twice (almost 20 minutes for some passengers).

III. RIDERSHIP FORECASTS

The travel demand forecasting for this Expanded Alternatives Analysis was performed by the Central Transportation Planning Staff (CTPS). The procedures used are based on the traditional four-step process using trip generation, trip distribution, mode choice and trip assignment. This process estimates average daily transit ridership, primarily on the basis of forecasts of population and employment, projected highway travel conditions (including downtown parking costs) and projected transit service to be provided. A more detailed description of the process and assumptions was included in the 1995 Feasibility Study.

The model is based entirely on new data obtained from a Home Interview Survey conducted in 1991. Population and employment inputs to the demand forecasting process were obtained from the Southeastern Regional Planning and Economic Development District (SRPEDD) and the Metropolitan Area Planning Council (MAPC). Network development and travel time estimation were performed using the MINUTP modeling package.

The market for the new rail service is composed primarily of work trips to downtown Boston as opposed to non-work trips or work trips contained entirely within the defined market area. Recent commuter rail surveys conducted by CTPS indicate that over 90 percent of all commuter rail trips are work trips destined to downtown Boston and East Cambridge.

As demonstrated in previous feasibility studies and shown in **Table 1**, the North Easton and East Taunton stations would attract the highest number of boardings. This reflects the large number of Boston bound work trips originating in North Easton and the good highway access attributed to the location of East Taunton station near the interchange of Routes 24/140.

Ridership in East Taunton is highest under the two alternatives using DMUs (1B and 3B). This reflects the fact that many Fall River, New Bedford, and Freetown commuters would find it more convenient to drive to East Taunton to avoid the 7 to 12 minute delay associated with DMU coupling.

Roughly equal numbers of riders would board at the Fall River and New Bedford terminal each day. The Freetown and Taunton Center stations would attract more moderate ridership. The Dean Street station avoids many of the grade crossing and community impacts identified by local Taunton officials, but would attract slightly less riders than a Taunton Center station.

Table 2 presents the projected bus boardings for each alternative. For each of the rail alternatives, commuter bus service would remain as existing.

TABLE 1
Rail Boardings By Station - Year 2010
(Inbound Person Trips)

<u>Station of Origin</u>	<u>Alternatives</u>							
	<u>1A</u>	<u>1B</u>	<u>2A</u>	<u>2B</u>	<u>2C</u>	<u>2C-1</u>	<u>3A</u>	<u>3B</u>
Fall River	650	370	350	490	375	480	620	360
Freetown	475	250	165	275	175	270	430	240
New Bedford	700	400	390	585	415	570	600	380
East Taunton	860	1,450	415	695	445	710	875	1,100
Taunton Center	545	500						
Dean Street							400	400
Raynham							300	300
North Easton							1,100	1,110
Total Rail Boardings	3,230	2,970	1,320	2,045	1,410	2,030	4,325	3,890

TABLE 2
Bus Boardings By Station - Year 2010
(Inbound Person Trips)

<u>Stations</u>	<u>Alternatives</u>								
	<u>1A</u>	<u>1B</u>	<u>2A</u>	<u>2B</u>	<u>2C</u>	<u>2C-1</u>	<u>3A</u>	<u>3B</u>	<u>4</u>
Taunton	135	150	400	395	400	405	75	150	300
East Taunton									600
Raynham	55	55	55	60	55	60			250
West Bridgewater									115
Easton									660
New Bedford	155	180	330	280	335	285	50	210	775
Fall River	45	15	325	260	300	265	35	110	500
Freetown									300
Total Bus Boardings	390	400	1105	995	1,090	1,015	160	470	3,500

*Combined rail and bus boardings are shown in **Table 3** on the following page.*

Under all commuter rail alternatives, bus boardings would be lower than the 1,450 daily passengers predicted for the year 2010 if no rail extensions were constructed. This is particularly true for the Attleboro and Stoughton alternatives which offer more competitive travel times to Boston. Table 3 presents a summary of ridership, with combined bus and rail boardings for each alternative.

TABLE 3
Year 2010 Ridership - Rail and Bus Boardings Combined

Alt. No.	Description	Train Boardings ¹	Bus Boardings ²	Total Ridership	New Transit Riders ³
-	No Build	-	1,450	1,450	-
1A	NB/FR via Attleboro	3,230	390	3,620	2,180
1B	NB/FR via Attleboro - DMU Service	2,970	400	3,370	1,920
2A	NB/FR via Middleborough	1,320	1,110	2,430	995
2B	NB/FR via Middleborough - "Skip Stop"	2,045	995	3,040	1,615
2C	NB/FR via Middleborough - Relocated Lakeville Station	1,410	1,090	2,500	1,070
2C-1	NB/FR via Middleborough - Shuttle, Cross Platform Transfer	2,030	1,015	3,045	1,600
3A	NB/FR via Stoughton	4,325	160	4,485	3,040
3B	NB/FR via Stoughton DMU Service	3,890	470	4,360	2,915
4	Enhanced Commuter Bus	-	3,500	3,500	1,790

¹ Total daily inbound boardings at all new stations on the extension

² Total daily inbound boardings from the study area

³ Total inbound trips diverted from the automobile mode

Alternative 3A, serving both Fall River and New Bedford via an extension of the Stoughton Branch, has the highest ridership with 4,325 daily inbound train boardings. In terms of diverting commuters from the automobile and achieving air quality benefits, this alternative would also be the best. This alternative provides service to the two stations with the highest ridership: East Taunton and North Easton stations.

Alternative 1A, via the Attleboro bypass, has slightly lower train boardings of 3,230. While level of service and travel times are marginally better than on a Stoughton extension, this alignment does not serve the highly attractive North Easton station and thus attracts lower ridership.

DMU alternatives along either the Stoughton or Attleboro route offer twice as much service to Fall River and New Bedford, but ridership is 6 to 10 percent lower. This is due to current federal regulations which add a 7 to 12 minute time penalty for brake tests during DMU coupling.

Alternative 4 - Enhanced Commuter Bus, would attract the second largest ridership, increasing bus ridership by more than 100 percent. More than 3,500 passengers would use enhanced New Bedford, Fall River and Taunton bus service due to lower fares, free transfers to the MBTA rapid transit system (i.e. acceptance of MBTA monthly passes) and increased commuter parking availability. An estimated 1,790 of these commuters would be diverted from automobiles.

Middleborough line Alternatives 2A and 2C have the lowest ridership potential. Even Alternatives 2B and 2C-1, which have service levels and travel times which are more competitive with the Attleboro and Stoughton routes, attract only 2,045 inbound train riders. The relocation of Lakeville station would reduce travel time by about 10 minutes, but would have little impact on ridership as demonstrated by the minimal difference between Alternatives 2A and 2C.

It should also be noted that the use of supplemental shuttle service to increase ridership on the Middleborough line alternatives (2B and 2C-1) could also be implemented for the Stoughton and Attleboro line alternatives. This would further increase ridership levels on these routes and amplify the relative benefits of these routes as compared to the Middleborough line options.

For comparison purposes, the following ridership statistics are provided from 1995 ridership counts on other MBTA commuter rail lines. Only Alternatives 1A or 3A, with service via Attleboro or Stoughton, would attract ridership at levels comparable to other MBTA lines.

<u>Existing Commuter Rail Line</u>	<u>1995 Daily Inbound Boardings</u>
Attleboro/Stoughton	11,750
Rockport/Ipswich	6,420
Franklin	6,150
Framingham	5,430
Haverhill	4,060
Lowell	4,030
Fitchburg	3,850
Needham	3,500
Fairmount/Dorchester (branch)	1,410

IV. OPERATIONAL ISSUES

A. GENERAL OPERATIONAL ISSUES

Operational simulations were developed along each of the three alternative alignments to determine the feasibility and impact of Fall River/New Bedford service in the year 2010. These simulations were developed utilizing a sophisticated computerized simulation tool called RAILSIM. These simulations helped to develop travel times and service schedules for each alternative (see **Table 4**). The results were then used to identify and evaluate any operating issues as described further below. Bus travel times were generated from the regional model.

TABLE 4
Rail and Bus Alternative Trip Times

Alt. No.	Description	Total Route Miles ¹	# of Stations (total/new)	# of Pk. Period Trains ²	Peak Trip Time ³ (hr:min)	Trains per day ⁴
1A	NB/FR via Attleboro	61/58	8/5	3	1:12	18/18
1B	NB/FR via Attleboro-DMU Service	61/58	8/5	5	1:24 ⁴	36/36
2A	NB/FR via Middleborough	61/58	12/4	2 or 3	1:36	13/13
2B	NB/FR via Middleborough - Skip-Stop, Shuttle/Transfer	61/58	9/4	5	1:17 ⁴	18/18
2C	NB/FR via New Lakeville Station	59/56	12/5	2 or 3	1:25	13/13
2C-1	NB/FR via New Lakeville Station, Shuttle/Transfer	59/56	13/5	5	1:30 ⁴	26/26
3A	NB/FR via Stoughton	54/51	9/7	3	1:13	17/17
3B	NB/FR via Stoughton-DMU Service	54/51	9/7	5	1:25 ⁴	34/34
4	Enhanced Commuter Bus	varies	10/3	n/a	1:30	n/a

¹ Distances from New Bedford / Fall River to Boston

² Number of peak period trains to each terminal

³ Times are for New Bedford. Add about two minutes for the Fall River trip.

⁴ Total daily (inbound + outbound) trains to New Bedford/Fall River.

⁵ Time includes transfer or DMU coupling at East Taunton station; travel on through trains is 5 minutes faster.

Maximum train speeds were generally assumed to be 70 mph along all lines, with the exception of the Northeast Corridor on which future speeds were assumed to be 100 mph. Slower speeds of 30 mph were maintained along sections in Taunton to account for the frequent sharp curvatures and numerous grade crossings. A dwell time of one minute was assumed for all station stops.

Layover Facilities

New layover facilities would be required in New Bedford and Fall River. The Middleborough layover facility being constructed as part of the Old Colony project would definitively need to be utilized only under Alternative 2B. If all Middleborough service were extended beyond this point, the need to retain some layover capability at this midpoint would need to be further evaluated.

Cross Platform Transfers

To overcome Main Line capacity limitations, service frequency to New Bedford and Fall River could be improved by operating shuttle trains between the terminals and East Taunton. This type of operation was incorporated into Alternatives 2B and 2C1. This type of service could also be used to boost service levels and ridership on the Attleboro and Stoughton options as well.

A shuttle train and a larger, through-routed train would alternately serve each city. Every other train leaving New Bedford would be a shuttle. In theory, both the shuttle and the through-routed train departing NB/FR would be scheduled to arrive at East Taunton simultaneously. This requires that the right-of-way between Myricks and East Taunton Station be double tracked. The two trains would pull up to an island type platform and patrons would cross from one train to another to continue the inbound trip. Shuttle trains can be either DMUs or a locomotive pulled consist. A comparative evaluation of the relative costs for operating DMU or traditional equipment is performed later in this report for the purposes of identifying operating costs.

B. NEC CONSTRAINTS

The Northeast Corridor (NEC) Improvement Project consists of a major upgrade of Amtrak's Shore Line which operates between Boston and New York. The project involves electrification of the line to facilitate three-hour trip times between Boston and New York. Amtrak plans to run faster and more frequent service on the line (34 trains daily in the year 2010 as opposed to the current 16). This increase will limit the number of additional trains that the MBTA can operate along this corridor.

As part of this expanded alternatives analysis, operational simulations were developed for year 2010 service levels to test the number of trains that could enter the Northeast Corridor from either the Attleboro bypass or the existing Stoughton Branch. The simulations determined that up to 36 trains per day could access the corridor in the Attleboro area. The simulation

determined that the number of additional trains that could access the corridor from the existing Stoughton Branch was 34 per day. This number is slightly less than via Attleboro because of the scheduling of service on the Northeast Corridor.

This identified capacity for 34 to 36 additional trains entering the Northeast Corridor from the Attleboro or Stoughton alignments is somewhat reduced from the 44 trains that were assumed in the 1995 Feasibility Study.

Simulation results also showed that, to accommodate additional traffic without disrupting Amtrak or MBTA Shore Line services, the proposed Attleboro bypass would need to be double-tracked. This would facilitate the passing of trains moving in opposite directions and to quickly move trains on and off of the Northeast corridor.

C. MIDDLEBOROUGH LINE OPERATIONAL ISSUES

Old Colony Capacity Constraints

Old Colony system constraints are primarily a result of capacity limitations north of Braintree on the Main Line. The three Old Colony lines from Middleborough, Plymouth and Greenbush merge in Braintree and proceed north to South Station on a shared 9.8 mile section of single track known as the Main Line. The limited capacity of this Main Line segment constrains operations on the entire Old Colony system.

The Main Line must accommodate 76 trains per day from the Plymouth, Greenbush and Middleborough branches. Operations will be particularly constrained during the peak periods when each Old Colony branch will be served by 5 trains in the peak direction. To minimize equipment requirements, the first AM peak-period train arriving at South Station from each line is scheduled to run a reverse peak trip to also serve as the fifth inbound train. Thus, morning peak operations on the Main Line will consist of 15 inbound trains (five from each line) and 3 outbound trains (one to each line). The PM peak will operate in a similar manner. Two platforms at South Station will be dedicated to Old Colony trains. The platforms selected (track #11 and #12) provide for direct movement onto the Old Colony tracks and help the efficient movement of trains.

The 1995 Feasibility Study evaluated Middleborough line options that serve only one terminal, either New Bedford or Fall River. The assumption was that no additional service could be added to the Main Line. This was designed to offer a high level of service to one terminal rather than infrequent service to both. As part of this current analysis, four new Middleborough alternatives were developed.

Alternatives 2A, 2C and 2C-1 would operate as extensions of Old Colony service. No simulations were performed for these alternatives because there would *theoretically* be no additional trainsets added to the Main Line north of Braintree. (This is *theoretical* because some additional trainsets would likely need to operate to make up for the long distances of this extended service and to maintain Old Colony schedules.) However, there are two issues related to the operation of these alternatives that would limit implementation::

- 1) The additional 35 miles of track incorporated into service would introduce increased delay minutes throughout the entire Old Colony system. This factor is discussed in more detail below.
- 2) The extended trains would not have the capacity to accept both New Bedford/Fall River and Old Colony Middleborough line passengers. The maximum capacity of MBTA trains, once locomotive power is overhauled and upgraded, will be 1,550 passengers. In the year 2000, the Middleborough line is forecast to carry 1,321 passengers on the peak train. Alternatives 2A and 2C are projected to carry about 447 additional riders on the peak train. Together, this ridership would be 218 passengers or 14 percent over capacity.

Capacity issues would be more severe under Alternative 2C-1, where an additional 657 riders would put Middleborough line service *27 percent over MBTA service standards for passenger loading.*

Impact of Additional Service

Alternative 2B was developed to test the theory that additional trains from New Bedford/Fall River service could be operate "in tandem" with Old Colony Middleborough service. A simulation was performed in an attempt to schedule these trains in "fleets" using the same Main Line time slots to reach South Station. This approach would increase the number of trains serving New Bedford and Fall River to four trains at both terminals during each peak period.

The simulation allowed for an evaluation of performance levels along the Old Colony Main Line as well as at certain station locations. Signal delay minutes were monitored to determine if the additional trains could be incorporated within the Old Colony schedules. The resulting data were used to evaluate the stability of the overall operating schedule under realistic day-to-day conditions.

As expected, the simulation demonstrated that the Main Line is the 'choke point' or location where operations are most severely constrained and where there is the least opportunity to recover from schedule delays. While it would be *theoretically feasible* to add additional trains to the Main Line, it would have a tremendous impact on Old Colony schedules and performance levels.

A single delay, which is almost unavoidable on a day to day basis, could disrupt the tightly scheduled Main Line operations and impact operations on all three branches. During the AM peak, virtually all trains travelling the Main Line to South Station would be delayed. During the PM peak, all service would be late with the exception of one train. The potential for these delays is not theoretical. On a typical weekday, roughly 42 of the 400 scheduled MBTA trains (about 10 percent) experience delays between one and five minutes. During severe snowstorms or other inclement conditions, these "minor" delays are even more frequent.

The potential impact of such delays cannot be overstated from an operational standpoint — schedule fluctuation on the Main Line segment could dead-lock service on all three Old Colony branches affecting the daily commute for more than 15,000 Old Colony passengers.

The results show that even the fixed levels of Main Line service proposed under Alternatives 2A, 2C and 2C-1 would result in an extremely fragile operating plan, by introducing an additional 35 miles of track to a system in which delay minutes cannot be tolerated.

Elimination of reverse peak service on the Old Colony line would have minimal impact on alleviating these capacity constraints. Elimination of the three scheduled reverse peak trains would *theoretically* open up slots for two additional New Bedford/Fall River trains. This action, however, would preclude the recycling of Old Colony trainsets during the peak period and add \$32 million to project costs to acquire three additional trainsets.

In summary, Middleborough alternatives which simply extend service (2A, 2C and 2C-1) would not be able to accommodate both New Bedford/Fall River and Old Colony passengers without adding additional trains. The addition of New Bedford/Fall River trains to the tightly constrained Old Colony Main Line was tested under Alternative 2B. The results demonstrate that increased train traffic would have significant impacts on the level of service provided to Old Colony passengers. It would further preclude any future increase in service levels on the three Old Colony branches.

Capacity constraints along the Main Line can only be alleviated by the addition of a second track. The level of development along this corridor in Dorchester and Quincy would require numerous property takings. Construction of a second track would cost over \$100 million in infrastructure, plus land acquisition and relocation costs of a significant magnitude.

Relocation of Middleborough/Lakeville Station

The Middleborough/Lakeville terminal of the Old Colony Middleborough line is presently being constructed about one mile south of the Middleborough Secondary Junction. For New Bedford/Fall River trains to serve this station, they would have to travel one mile south of the junction; perform a brake test; then reverse direction to travel one-mile north to reach the Middleborough Secondary. The additional trip time associated with this effort is about 11 minutes.

To avoid this "reverse move", several locations were considered for relocating Middleborough/Lakeville Station either north of the Junction or onto the Middleborough Secondary. As described in more detail under the description of Alternative 2C, three potential sites were identified. While it would be possible to move the station to one of these locations there are two additional considerations that would need to be further evaluated:

- 1) Relocation would require the MBTA to modify or rescind existing commitments made to the residents of Lakeville as part of the Old Colony project.
- 2) The Federal Transit Administration may require reimbursement of the costs for designing and constructing the current Middleborough/Lakeville terminal (up to \$5 million). This reimbursement would be triggered by the MBTA's abandonment and demolition of a facility built with federal funds as identified under an existing federal grant commitment.

D. DMU OPERATIONAL AND REGULATORY ISSUES

In its simplest form, a DMU (Diesel Multiple Unit) is best described as a conventional passenger coach with a diesel engine, which allows the coach to operate without a locomotive. Modern DMUs, which are updated versions of the old "Budd" rail diesel cars used in Boston until the late 1970's, are in widespread use in both Europe and Japan. There is a growing interest in reintroducing this technology in the U.S. to take advantage of increased operational flexibility and other operational benefits provided by these trains.

DMUs possess characteristics that may make them suitable for New Bedford/Fall River service. Because they can operate in small one or two car pairs, they can much more efficiently serve a wide range of ridership volumes. They may also be coupled with additional cars to make larger consists which makes them ideally suited for branched service. This ability to join smaller consists into larger trainsets provides the ability to offer increased service on each branch without increasing train activity north of East Taunton.

As part of this expanded alternatives analysis, the MBTA's consultant prepared a technical memorandum on the cost to operate and maintain DMUs and evaluated their performance as part of several operational simulations. The conclusions of these analyses include:

- In short consists, DMUs are more efficient to operate and maintain than locomotive-hauled equipment of similar capacity. The higher costs for each individual coach limit their advantage to consists with less than 400-600 passengers.
- Better fuel economy makes DMU's more attractive as the price of fuel increases.

- While European operators routinely couple and uncouple DMUs "on the fly", current Federal Railroad Administration (FRA) safety regulations require that brake tests be performed after coupling. This adds about 7 minutes to the operating schedule.
- Also, as with any standard consist, an adequate headway must be maintained between trains operating along a track segment. For two inbound DMUs planning to couple at East Taunton, this implies that the second DMU would have to trail the first by five minutes minimum. Thus, the combination of train spacing and brake testing would result in a total delay of 12 minutes for these passengers.

As interest in the use of DMU technology increases in the United States, it is hoped that the FRA would develop special rules for DMUs to overcome some of the operating restrictions noted above. However, all simulations conducted for this expanded analysis conservatively assumed that all current regulations would apply.

E. OTHER CONSIDERATIONS

South Station Capacity

The 1995 Feasibility Study included an evaluation of the track capacity at South Station. The estimated station capacity for 2010 took into account the additional track space required for Old Colony Service, MBTA service to Worcester, increased service along the Franklin line, extension of service to New Bedford/Fall River and additional Amtrak service along the Northeast Corridor. The results showed that South Station can accommodate New Bedford/Fall River service, but will essentially be at capacity in the year 2010, particularly in the evening peak.

It is recommended that this issue, regardless of the alignment selected, be further investigated following the selection of a preferred alignment. This would be particularly important for any option that added service to the Old Colony system, because the two platforms dedicated for Old Colony trains would be unable to accommodate additional trains during the peak periods. Any additional service, as considered under Alternative 2B, would need to board passengers at alternate platform locations. The dedicated Old Colony platforms are situated to provide for direct and efficient access onto the Main Line. The need to route trains across South Station operations would increase the potential for operational delays.

Potential Service to Bourne via Middleborough

In September, 1996, the MBTA completed a feasibility study of a potential extension of Old Colony Middleborough service to Bourne and Cape Cod. This study found that such an extension would attract 1,200 inbound passengers (or 2,400 total) trips per weekday. The extension of service to Fall River and New Bedford via Middleborough would limit the feasibility of operating through service to Bourne and Cape Cod. Further analysis would need to be performed to determine if double tracking north of Braintree could accommodate both new lines.

V. ENVIRONMENTAL ASSESSMENT

A. BACKGROUND

A project of this magnitude is required to be reviewed by MEPA. In September 1995, an ENF to extend rail service via the Attleboro route was submitted to MEPA. In December 1995, the Secretary of the Executive Office of Environmental Affairs (EOEA) issued a Certificate on the proposed Attleboro Route. This Certificate required the preparation of an Environmental Impact Report for the proposed Attleboro bypass segment of the project. No additional environmental review was required for track reconstruction or stations. If a different alternative were to be pursued, additional review by MEPA would be required.

This Chapter compares the potential environmental impacts likely to occur from the rail alternatives and the bus alternative. The information presented is only intended to be a summary of potential impacts to facilitate comparison. Accordingly, this assessment only considers the alternative routes north of Cotley Junction. All alternatives are assumed to have identical environmental impacts from Cotley Junction south.

B. ENVIRONMENTAL REVIEW OF ALTERNATIVES

A series of environmental issues (i.e. wetlands, floodplains, waterways, biological resources, noise, and air quality) are presented below as part of a cursory review. Grade crossings are also discussed because of the noise and traffic issues which effect abutments on each rail alternative. Environmental issues relating to station development were considered only when alternative station locations were investigated (as described earlier under the Description of Alternatives).

This summary focuses only on permanent impacts. Minor temporary impacts would be encountered as a result of construction activities (bridge abutment work, site access, etc.)

Wetlands, Floodplain and Waterways

Significant portions of the right-of-ways being considered are within 100 feet of wetland resource areas and receive protection under the Massachusetts Wetland Protection Act. Most actions would require the filing of a Notice of Intent (NOI) permit with local conservation commissions.

The Attleboro Route

Due to the construction of a new 2.5-mile double-tracked bypass between the Shore Line and the Attleboro Secondary, this alternative would directly affect about 5.4 acres of wetlands.

Impacted resources would include relatively mature forested wetland, marsh, and shrub swamp

wetlands, and potentially could affect larger areas due to changes in hydrology. The filling of wetlands would require that a variance be obtained from the Wetlands Protection Act Regulations.

This alternative would result in direct impacts to two surface water streams. The line crosses waterways at 14 locations and runs parallel to about 400 feet of a tributary to the Wading River which would require relocation or culverting. Direct impacts would result from the placement of ballast material and culverts within the watercourse channels.

The 100-year floodplain borders the right-of-way embankment base, but does not extend onto the tracks. Portions of the new track would be within riverfront areas.

The Middleborough Route

This alternative would result in the least impact to wetland and water resources primarily due to the fact that the entire alignment uses an active rail line. Construction of the Wye connector at Cotley Junction would adversely affect approximately 5,000 square feet of wetlands, but would not be likely to require issuance of a Wetlands Variance. The line crosses nine streams in culvert structures, although no impacts are expected. No construction within or adjacent to the 100 year floodplain is anticipated.

The Stoughton Route

The line passes through the 17,000 acre Hockomock Swamp ACEC (Area of Critical Environmental Concern). This is the largest freshwater wetland system in the state. It provides habitat for at least 13 rare and endangered species and has public recreational values. An ACEC is a designation established by the EOEA for especially sensitive environmental resources.

This alternative would require the construction of a 3.2 mile section of track in the Hockomock Swamp ACEC and a 1-mile section in Pine Swamp both on existing embankments. This work would be within the buffer zone, but would not alter wetlands in the ACEC.

Approximately two acres of wetlands, outside the ACEC, would be directly affected by the project. This includes locations where the former railbed is in a cut section where wetland vegetation exists due to impeded drainage. These recently-established wetlands have a disturbed substrate and vegetation, and provide lower functions and values than do older natural wetland systems. The limited functions and values should be factors that would argue in favor of the granting of a Wetlands variance.

The line also crosses 24 surface waterways, and direct impacts would occur at two streams which have cut through the abandoned rail bed and would need to be replaced with culverts. The 100-year floodplain borders the right-of-way embankment base, but does not appear to extend onto the tracks.

The right-of-way through the ACEC serves as a recreational trail and provides wildlife refuge uses. Although it was originally purchased for transportation uses prior to the designation of the ACEC, some replacement of this recreational use may need to be considered.

Wildlife and Rare Species

Wildlife habitat within the proposed powerline right-of-way in Attleboro would be reduced in area and fragmented due to the clearing of about 15 acres of land. The Stoughton alternative would result in direct loss to wildlife habitat along the abandoned trackbed and through the Hockomock Swamp ACEC and Pine Swamp. Rare fish species are present in the Taunton River, which is crossed by both the Attleboro and Stoughton routes. However, careful construction sequencing of bridge repair and mitigation should prevent adverse impacts from occurring to that species.

The Middleborough alternatives would not adversely impact wildlife or rare species due to the fact that the track is in service. New track construction at Cotley Junction and the Middleborough Wye would not affect any areas of important wildlife habitat.

Noise And Vibration

Each alternative would generate an increase in the existing ambient noise levels along the specific rail corridor. The amount of noise level increase is directly dependent on the current level of train activity in that corridor and the level of new train service proposed. In the built-up areas of Easton Center, Taunton, New Bedford and Fall River, the increase in noise levels may be a concern.

Noise and vibration impacts are generally correlated with the distance and number of residential and other land uses along the right-of-way. **Table 5** identifies and compares the number of noise receptors (residences and businesses) located within 150 feet of each right-of-way north of Cotley Junction (150 feet is generally the distance from which noise impacts would be experienced). Noise impacts are typically associated with noise from the train itself, grade crossing bells and the blowing of train whistles. Recent changes in federal regulations have introduced alternative grade crossing measures to replace the blowing of train whistles in some locations.

Based on the quantitative abutter assessment, it appears that the Middleborough Line would cause the least noise impacts to commercial and residential structures located within 150 feet of the right-of-way. The Attleboro route has the next greatest number of abutters, with most located in the Taunton area. The Stoughton route has the greatest potential for residential impact, with land use impacts mainly in Taunton, Easton, and Stoughton.

TABLE 5**Abutters within 150 feet of the Right-of-Way: To Cotley Junction**

<u>Town</u>	<u>Attleboro</u>		<u>Middleborough</u>		<u>Stoughton</u>	
	<u>Residential</u>	<u>Commercial</u>	<u>Residential</u>	<u>Commercial</u>	<u>Residential</u>	<u>Commercial</u>
Mansfield	4	0	0	0	0	0
Attleboro	0	0	0	0	0	0
Norton	13 (11)	3 (3)	0	0	0	0
Stoughton	0	0	0	0	44	63
Easton	0	0	0	0	58 (14)	33 (18)
Raynham	0	0	0	0	19 (16)	9
Taunton	121 (106)	31 (30)	9 (5)	1 (0)	52 (17)	16 (11)
Lakeville	0	0	4 (8)	2 (0)	0	0
Middleborough	0	0	20 (0)	5 (0)	0	0
Total	138 (131)	34 (33)	33 (13)	8 (0)	173 (91)	121 (101)

Number in () indicates abutters who are within 150 feet of an at-grade crossing, if different from total.

Vibration impacts may also be a concern in developed areas. One area identified that may require some vibration protection is the historic area of North Easton. It is possible that some sections of track in North Easton may require a deeper ballast section than usual.

Grade Crossing Impacts

The number of at-grade crossings that would be required for each of the three alternative routes north of Cotley Junction is shown in Table 6. The crossings south of Cotley were discussed in the previous feasibility studies and are not a factor in selecting a preferred alternative. Crossings north of Lakeville on the Middleborough Line will be impacted by the additional service under alternative 2B. All grade crossings would be protected by automatic gates and crossing signals (bells and flashers).

Attleboro Route: Most of the Attleboro route is in use by both freight and passenger service and would involve 19 existing at-grade crossings and one new crossing.

- One new at-grade crossing would be constructed along the Attleboro bypass, although the Route 123 crossing in this area would be grade separated.
- Fifteen grade crossings are located in Taunton.
- Nine grade crossings have low traffic volumes
- Five grade crossings experience relatively high traffic volumes.

Middleborough Route: The Middleborough Secondary is an active Conrail freight line, with only five existing at-grade crossings.

- One grade crossing has low traffic volumes and is located on a residential street.
- Three grade crossings have low-moderate traffic volumes and are located on residential/industrial roadways.
- One crossing (Route 140) has high traffic volumes and is located on a commercial highway.

The Middleborough line from Braintree to Lakeville has 15 public and 6 private grade crossings.

Stoughton Route: The Stoughton route is not currently active and would require the reconstruction of 24 new at-grade crossings.

- Five crossings have low traffic volumes and are located on residential or industrial roadways.
- Eight grade crossings have low-moderate traffic volumes and are located on a combination of residential/commercial/industrial streets.
- Ten crossings have moderate traffic volumes and are located on a combination of residential/commercial/industrial streets.

The Route 138 grade crossing has high traffic volumes and will require the construction of a grade-separated railroad crossing.

TABLE 6
Summary of At-Grade Crossings: To Cotley Junction

<u>Town</u>	<u>Attleboro</u> <u>No. Of Crossings</u>	<u>Middleborough</u> <u>No. Of Crossings</u>	<u>Stoughton</u> <u>No. Of Crossings</u>
Attleboro	1	0	0
Norton	4	0	0
Stoughton	0	0	5
Easton	0	0	8
Raynham	0	0	6
Taunton	15	2	5
Lakeville	0	1	0
Middleborough	0	2	0
Total	20	5	24

Traffic Issues and Regional Air Quality Benefits

Traffic analysis for this study was limited to the calculation of trips diverted from automobiles to transit and a determination of savings in total vehicle miles traveled (VMT). As shown in Table 7, the greatest reduction in total VMT and hence the greatest benefit to air quality would be realized by the Stoughton Route (Alternative 3A). The Commuter Bus Alternative and the Attleboro Route (Alternative 1A), also have relatively high VMT savings and reductions in air pollutants. The Middleborough alternatives do not reflect high VMT savings and therefore have relatively fewer air quality benefits.

TABLE 7

Regional Air Quality Benefits

Alt. No.	Description	Total Transit Riders	Daily VMT ¹ Savings	Daily Reductions		
				NOx (Kg)	CO (Kg)	VOC (Kg)
1A	NB/FR via Attleboro	3,230	169,290	1185.7	169.1	96.0
1B	NB/FR via Attleboro - DMU Service	2,970	137,470	962.8	137.3	77.9
2A	NB/FR via Middleborough	1,320	72,110	72.1	505.1	40.9
2B	NB/FR via Middleborough - Skip Stop, Shuttle/Transfer	1,320	99,765	99.7	698.8	56.6
2C	NB/FR via Middleborough - New Lakeville Station	1,410	77,570	77.5	543.3	44.0
2C-1	NB/FR via Middleborough - New Lakeville Station, Shuttle/transfer	2,030	98,790	98.7	691.9	56.0
3A	NB/FR via Stoughton	4,305	204,250	1430.6	204.1	115.8
3B	NB/FR via Stoughton - DMU Service	3,890	202,135	1415.8	201.9	114.6
4	Commuter Bus	3,385	112,216	112.1	785.9	63.6

¹ VMT = Vehicle Miles of Travel

A full analysis of the traffic impacts and benefits related to each alternative, including traffic issues at station sites, would be performed as part of the next phase of environmental analysis. Some stations will require a MHD curb cut permit for access to state highways. Curb-cuts are needed where more than 200 spaces are proposed or where a change in use would occur.

Environmental Issues Related to the Enhanced Commuter Bus Alternative

The bus routes remain essentially unchanged from the existing condition. The new bus stops at Freetown, East Taunton and Easton, and any existing bus stops where expansion may occur, would experience some increases in noise and traffic levels. There is the potential for some wetland and/or resource impact during park-and-ride construction; any design effort would aim to minimize such impacts.

Table 8 summarizes the potential environmental and community impact of each alternative alignment north of Cotley Junction.

TABLE 8
Summary Comparison of Environmental Issues

	Attleboro Route	Middleborough Route	Stoughton Route
Wetlands	Adverse impacts to 5.4 acres	Adverse impacts to 5,000 s.f.	Adverse impacts to 2 acres within old railbed
100 Year Floodplain	Impacts to floodplain along bypass.	No impacts to floodplain	Restore 1 culvert within floodplain
Waterways	14 crossings, 2 impacts, 400 ft of affected stream	9 crossings, no impacts	24 crossings, new culverts at 2 streams
ACEC	No impact	No impact	Potential effects on wildlife, rare species, and public recreation
Wildlife and Rare Species	Loss of 15 acres of habitat. Construction impacts at Taunton River	No significant effect	Minor loss of habitat Construction impacts at Taunton River Bridge
Noise and Vibration	172 abutters within 150'	41 abutters within 150'	194 abutters within 150'
Grade Crossings	20	5/21 ¹	24

¹ Crossings between Lakeville and Cotley / Crossings between Braintree and Lakeville

VI. CAPITAL AND OPERATING COSTS

A. CAPITAL COSTS

As part of the expanded alternatives analysis, a detailed inspection and evaluation of the right-of-ways was performed by the MBTA's engineering consultants. Based on the results of these evaluations, the scope of improvements for each alternative was identified. Capital costs were developed by applying average unit costs from actual bid prices on the Old Colony project.

This evaluation found that the infrastructure upgrades required to construct commuter rail extensions to New Bedford and Fall River would be greater than originally anticipated. In some cases, there are significant differences in costs as compared to the 1995 Feasibility Study. These can be attributed to:

- A more detailed engineering evaluation of the upgrades required.
- Inflation from 1994 to 1996 dollars.
- The need for double track along the proposed Attleboro bypass.
- Identification of additional passing track.
- Installation of a high speed interlocking for connection onto the Northeast Corridor.
- Rerouting of the Stoughton alignment via Weir Junction and the required grade separation at Route 138.
- Installation of a more advanced cab signalling system, consistent with Old Colony design standards.
- Increased bridge rehabilitation costs identified from actual inspection reports.
- The incorporation of design engineering, construction administration and land acquisition costs.

The capital infrastructure costs for each alternative typically consist of the following: new track, bridge rehabilitation, stations, signals and communications, layover facilities, grade crossings, and drainage. The summary of these costs for each alternative is shown in **Table 9**.

Middleborough branch alternatives 2A, 2C and 2C1 have the lowest capital costs, ranging from \$252 million to \$265 million. These alternatives have the lowest costs because all of the right-of-way is in active use. Service under Alternative 2A, which simply assumes that Old Colony service would be extended to New Bedford and Fall River, has the lowest capital cost. Alternatives 2C and 2C1 involve additional costs for the relocation of Lakeville station. Alternative 2B is similar to Alternative 2A, yet involves an additional \$100 million for the construction of a second track along the Old Colony Main Line north of Braintree. The land acquisition costs associated with this double track have not been estimated and would likely increase this estimate significantly.

TABLE 9
Infrastructure Costs by Alternative (\$1996)

Project Element	Rail Alternative Costs (in \$mil)							
	Attleboro		Middleborough				Stoughton	
	1A	1B	2A	2B	2C	2C1	3A	3B
Track & Right-of-Way	115.9	115.9	96.1	96.1	96.1	96.1	122.5	122.5
Double Track Bypass	22.30	22.30	--	--	--	--	--	--
Layover Facility	4.5	4.5	4.5	4.5	4.5	4.5	6.8	6.8
Retaining Walls	9.1	9.1	2.6	2.6	2.6	2.6	5.6	5.6
Grade Crossings	11.1	11.1	7.4	7.4	7.4	7.4	13.1	13.1
Bridges	31.9	31.9	31.9	31.9	31.9	31.9	49.0	49.0
Intersections/Roadways	7.5	7.5	1.8	1.8	1.8	1.8	2.5	2.5
Stations	22.7	22.7	18.7	18.7	18.7	18.7	33.3	33.3
Signals & Comm.	47.1	47.1	31.4	31.4	31.4	31.4	41.9	41.9
DMU Maint. Facility	--	8.00	--	--	--	--	--	10.0
Reloc. Lakeville Sta. ¹	--	--	--	--	10.0	10.0	--	--
Double Track Main Line				100				
<i>Subtotal</i>	<i>272.1</i>	<i>280.1</i>	<i>194.4</i>	<i>294.4</i>	<i>204.4</i>	<i>204.4</i>	<i>274.7</i>	<i>284.7</i>
Contingency (10%)	27.2	28.0	19.4	29.4	20.4	20.4	27.5	28.5
Land Acquisition	10.0	10.0	6.0	6.0 ²	6.0	6.0	10.0	10.0
<i>Subtotal</i>	<i>309.3</i>	<i>318.1</i>	<i>219.8</i>	<i>329.8</i>	<i>230.8</i>	<i>230.8</i>	<i>312.2</i>	<i>323.2</i>
Engineering/Admin.(15%)	46.4	47.7	33.0	49.5	34.6	34.6	46.8	48.5
Total Infrastructure Costs	\$355.7	\$365.8	\$252.8	\$379.3²	265.4	\$265.4	\$359.0	\$371.7

¹ Includes FTA reimbursement for abandonment and demolition of the existing station.

² Does not include property acquisition or relocation costs north of Braintree.

The Attleboro and Stoughton alternatives are very similar in terms of costs, with the investment required ranging from \$355 million to \$371 million. These costs are higher due to longer distances for track replacement, and the need for more stations, bridges and structures. The Attleboro alternatives also require \$22 million for the bypass track and an interlocking at the Northeast Corridor junction.

The implementation of DMU service would add an additional \$8 to 10 million to the cost of each alternative. This cost is for the construction of a dedicated DMU maintenance facility (lower costs for Alternative 1B reflect a smaller facility for fewer trains). The shuttle service operated under Alternatives 2B and 2C1 was assumed to be operated with conventional equipment.

The commuter bus alternative has the lowest capital cost of \$13 million. As discussed in the 1995 Feasibility Study, some expansion of the South Station bus terminal would be required to accommodate additional buses each peak period. It was determined that a portion of the parking deck above the new terminal could be utilized to provide six additional bus docks. The estimated cost to modify the upper deck, including improved elevator and escalator access, would be about \$2 million. This expansion would provide additional bus capacity for southeastern Massachusetts bus carriers only. An estimated cost for constructing or expanding commuter bus park-ride lots was also included. A cost per space of \$3,000 was applied to the total number of new bus riders projected under the enhanced bus alternative. This figure assumes that approximately 2,050 new surface spaces would be constructed for a total cost of \$6.2 million. An additional \$2 million was incorporated to develop daytime layover capability closer to Boston; no sites were investigated as part of this study. After including a 25% contingency, the total capital costs for enhanced bus service is \$13 million.

Equipment estimates were generated based on the ridership forecasts determined for the year 2010. These are shown in **Table 10**, with unit costs based on current MBTA equipment costs. Peak period service at 30 minute headways requires that five trains leave each terminal. With 60 minute headways, this is reduced to two or three trains.

For Alternatives 1A and 3A, four 6-car consists are assigned to New Bedford and Fall River for peak period service. One of these consists would return from South Station in time to run a second peak period run. Alternatives 1B and 3B would have two or three car DMUs leaving each of the terminals at 30 minute intervals and then combining into a four or five car DMU at East Taunton. One reverse peak train could be provided.

Alternatives 2A, 2C and 2C1 are extensions of Middleborough trains and require three additional coaches per train (nine-car trains) to carry the additional ridership. One spare trainset was also assumed to help maintain schedule over the extended track distances.

TABLE 10
Equipment Requirements and Costs (\$1996)

Alt. No.	Description	Equipment Requirements				Cost (\$mil.)
		Bi-Level Coaches ¹	Loco- motives ²	DMU ³	Buses ⁴	
1A	NB/FR via Attleboro	24	4	--	--	\$51.2
1B	NB/FR via Attleboro - DMUs	--	--	16	--	\$40.0
2A	NB/FR via Middleborough	21	1	--	--	\$39.8
2B	NB/FR via Middleborough - Skip Stop, Shuttle/Transfer	27 ⁵	5	--	--	\$56.8
2C	NB/FR via Middleborough - Relocated Lakeville Station	21	1	--	--	\$39.8
2C-1	NB/FR via Middleborough - Relocated Lakeville Station, Shuttle/Transfer	24 ⁵	1	--	--	\$43.4
3A	NB/FR via Stoughton	24	4	--	--	\$51.2
3B	NB/FR via Stoughton - DMUs	--	--	20	--	\$50.0
4	Enhanced Bus Service	--	--	--	25	\$8.8

1. New bi-level coaches priced at \$1.8 million each.
2. New locomotives priced at \$2.0 million each.
3. New DMU car has an average price of \$2.5 million each.
4. New bus coaches priced at \$350,000 each. Bus requirements based on 1,790 new peak period bus passengers. Assumes one-third of buses can recycle.
5. Includes 3 single level coaches for shuttle at \$1.2 million each.

In addition to the through-routed trains, Alternative 2B and 2C1 would have conventional three car consists providing alternating 30 minute shuttle service between the terminals and East Taunton. Shuttle passengers would transfer cross-platform to the through-routed consist. A cost analysis found that the cost of operating DMU shuttles would similar to conventional trainsets. If DMUs were utilized elsewhere in the MBTA system in the future, the cost-effectiveness of their use as shuttles would increase.

Total project costs (including infrastructure, equipment, design, land acquisition and administration) are summarized in **Table 11**. This table also calculates the cost per new rider under each alternative.

TABLE 11**Capital Cost Estimates by Alternative (\$1996)**

Alt. No.	Description	New Track Miles ¹	Total Infrastruc- ture Cost ² (in \$mil.)	Total Equipment Cost (in \$mil)	Total Capital Cost (in \$mil)	Cost Per New Rider (in \$mil)
1A	NB/FR via Attleboro	42.1	\$355.70	\$51.20	\$406.90	\$0.19
1B	NB/FR via Attleboro - DMU Service	42.1	\$365.80	\$40.00	\$405.80	\$0.21
2A	NB/FR via Middleborough	35.9	\$252.80	\$39.80	\$292.60	\$0.29
2B	NB/FR via Middleborough Skip Stop, Shuttle/Transfer	35.9	\$379.30	\$56.80	\$436.10	\$0.27
2C	NB/FR via Middleborough Relocated Lakeville Station	35.9	\$265.40	\$39.80	\$305.20	\$0.29
2C-1	NB/FR via Middleborough Relocated Lakeville Station, Shuttle/Transfer	35.9	\$265.40	\$43.40	\$308.80	\$0.19
3A	NB/FR via Stoughton	46.1	\$359.00	\$51.20	\$410.20	\$0.13
3B	NB/FR via Stoughton - DMU Service	46.1	\$371.70	\$50.00	\$421.70	\$0.14
4	Enhanced Commuter Bus	192.9	\$13.00	\$8.8	\$21.8	\$0.01

1. Track miles reflect only those track segments not currently providing commuter rail service.

2. Infrastructure costs include design, administration, land acquisition and contingencies.

B. OPERATING COSTS

Commuter rail operating costs consist primarily of labor, fuel, train servicing and maintenance, and right-of-way maintenance. The daily train operations costs were determined by taking the total route miles traversed for each alternative and multiplying it by the average gross cost per train mile. The summary of total operating costs for each alternative is shown in **Table 12**.

TABLE 12
Total Operating Costs for Rail and Bus Alternatives (\$1996)

Alt. No.	Description	Daily DMU Cost	Daily Conventional Consist Cost	Total Daily Operating Cost
1A	NB/FR via Attleboro	--	\$83,685	\$83,685
1B	NB/FR via Attleboro - DMU Service	\$78,823	--	\$78,823
2A	NB/FR via Middleborough	--	\$25,367	\$25,367
2B	NB/FR via Middleborough - Skip Stop, Shuttle/Transfer	--	\$51,793	\$51,793
2C	NB/FR via Middleborough - Relocated Lakeville station	--	\$24,237	\$24,237
2C-1	NB/FR via Middleborough - Relocated Lakeville station, Shuttle/Transfer	--	\$38,149	\$38,149
3A	NB/FR via Stoughton	--	\$73,470	\$73,470
3B	NB/FR via Stoughton - DMU Service	\$79,114	--	\$79,114
4	Enhanced Commuter Bus	-	-	\$9,988

For this analysis, an average gross cost per train mile of \$39.50 was assumed based on systemwide operations. Costs for DMU service were developed based on experience gained from other DMU operators. Costs vary somewhat depending on consist size, as shown below 1996 dollars.

<u>Description of Service Operated</u>	<u>Gross Cost Per Train Mile</u>
Conventional Locomotive and six coach consist:	\$39.50
Shuttle train (locomotive and three coaches):	\$34.30
Two-vehicle DMU: Shuttling between NB/FR and East Taunton:	\$23.30
Three-vehicle DMU: Shuttling between NB/FR and East Taunton:	\$28.50
Four-vehicle DMU: East Taunton to South Station:	\$33.70
Five-vehicle DMU: East Taunton to South Station:	\$38.80

Gross operating costs for commuter buses are based on a \$2.85 per mile average, as provided to the MBTA by SERPEDD and the southeastern Massachusetts private bus carriers.

Daily revenue for each alternative was calculated by multiplying a weighted average one-way fare for each zone by the number of train boardings in that zone, adding revenue across all zones, and multiplying by two, to represent round trips. The weighted average one-way fare for each zone was calculated by assuming that 68% of all passengers use a monthly MBTA pass, with the remaining riders paying full fare. The resulting average fares do not reflect the use of other discounted fares, therefore this daily revenue represents the maximum expected. This methodology is consistent with the 1990 & 1995 Feasibility Studies.

Net daily operating costs were then developed for each alternative by determining the difference between gross operating costs and operating revenues. These estimates represent the actual cost to the MBTA to operate service under each alternative. Operating costs are a function of incremental train miles and shorter alternatives have less expensive annual operating costs. The summary of net operating costs is shown in **Table 13**.

The net daily operating costs for Middleborough service are substantially lower than for other alternatives. This reflects the significantly reduced level of service on Alternatives 2A and 2C and the fact that operating costs between Middleborough and Boston are absorbed as part of Old Colony operations. Alternatives 2B and 2C1 have somewhat higher net costs due to the additional service operated to Boston and/or the East Taunton shuttle.

The Stoughton and Attleboro alternatives are almost twice as costly to operate. Net daily costs for Stoughton are lower due to the more direct route to Boston and the higher ridership potential.

DMU service is more expensive generally due to the higher level of service provided. Twice as many trains operate between the terminals and East Taunton.

The enhanced bus service generates revenue in excess of estimated operations costs. The revenue generated is based on total patrons diverted from both automobiles and other transit.

TABLE 13**Net Daily Operating Costs for Rail and Bus Alternatives (\$1996)**

<u>Alt. No.</u>	<u>Description</u>	<u>Total Daily Cost</u>	<u>New Transit Riders¹</u>	<u>Daily Revenue²</u>	<u>Net Daily Operating Cost</u>
1A	NB/FR via Attleboro	\$83,685	4,360	\$24,972	\$58,713
1B	NB/FR via Attleboro - DMU Service	\$78,823	3,840	\$21,792	\$57,031
2A	NB/FR via Middleborough	\$25,367	1,990	\$10,526	\$14,841
2B	NB/FR via Middleborough - Skip Stop, Shuttle/Transfer	\$51,793	3,230	\$16,197	\$35,596
2C	NB/FR via Middleborough - Relocated Lakeville station	\$24,237	2,140	\$11,240	\$12,997
2C-1	NB/FR via Middleborough - Relocated Lakeville station	\$38,149	3,200	\$16,041	\$22,108
3A	NB/FR via Stoughton	\$73,470	6,080	\$30,505	\$42,965
3B	NB/FR via Stoughton - DMU Service	\$79,114	5,830	\$26,378	\$52,736
4	Enhanced Bus Service	\$9,988	3,580	\$14,820	(\$4,832)

1. Daily Ridership = Inbound Ridership * 2 (only auto diversions included)

2. Daily Revenues for commuter rail and bus are calculated using weighted average fares across eight zones. Average fares are based on a 68% passholder rate (based on MBTA operations) and assume maximum fare generation.

VII. ECONOMIC ANALYSIS

Annualized costs were developed to allow a cost comparison among alternatives that recognizes infrastructure, equipment and operating costs over the extended life of the project. Total annual costs, as shown in **Table 14**, represent the sum of annual operating costs, annualized vehicle purchases and annualized capital costs.

TABLE 14
Life Cycle Costing of Alternatives (\$1996)

Alt. No.	Description	Annualized Costs			Total Costs (\$mil)
		Operating Costs ¹ (\$mil.)	Equipment Costs (\$mil)	Capital Costs (\$mil)	
1A	NB/FR via Attleboro	\$26.2	\$4.8	\$31.6	\$62.6
1B	NB/FR via Attleboro - DMU Service	\$24.7	\$3.7	\$32.5	\$60.9
2A	NB/FR via Middleborough	\$7.9	\$3.7	\$22.4	\$34.0
2B	NB/FR via Middleborough - Skip Stop, Shuttle/Transfer	\$16.2	\$5.3	\$33.7	\$55.2
2C	NB/FR via Middleborough - Relocated Lakeville Station	\$7.6	\$3.7	\$23.6	\$34.8
2C-1	NB/FR via Middleborough - Relocated Lakeville Station, Shuttle/Transfer	\$11.9	\$4.1	\$23.6	\$39.6
3A	NB/FR via Stoughton	\$23.0	\$4.7	\$31.9	\$59.6
3B	NB/FR via Stoughton - DMU Service	\$24.8	\$3.7	\$33.0	\$61.5
4	Enhanced Bus service	\$3.1	\$0.8	\$0.9	\$4.8

1. Annual Operating Costs = daily operating cost * 261 weekdays, plus 50% service assumed on weekends.

Annual operating costs assume the daily operating costs would apply for 261 weekdays with reduced service on weekends. Equipment costs and capital costs were annualized based on an 8% interest rate. Rail equipment was assumed to have a vehicle life of 25 years, buses were assumed to have a vehicle life of 12 years. Capital costs for trackwork and other right-of-way

improvements assumed a structure life of 30 years. Operating costs are a function of incremental train miles and shorter alternatives have less expensive annual operating costs.

Middleborough alternatives would have the lowest annualized costs. These overall costs are substantially lower for Alternatives 2A, 2C and 2C-1 because operating miles and capital infrastructure needs are substantially less than needed on either the Attleboro or Stoughton routes. Alternative 2B, which would require the construction of a double track along the Old Colony Main Line north of Braintree, would have annualized costs that are in the same range as Attleboro and Stoughton.

Table 15 presents the net operating costs and fare box recovery ratios for each alternative. Net operating costs are a function of incremental route miles and ridership. Corridors that have high total operating costs can still have reasonable net operating costs if ridership is high. The fare box recovery ratio reflects the percentage of total operating costs offset by fare collection.

Fare box recovery would be greatest for the Stoughton and some Middleborough options. The cost-effectiveness of the Stoughton service is a result of high ridership which offsets relatively long operating distances. The cost-effectiveness of the Middleborough routes is greatest for those which operated as extensions of Old Colony service. Although ridership is relatively low, the numbers reflect that much of the operating costs are absorbed into the Old Colony System.

The lowest fare box recovery ratios are shown for the Attleboro route and the Middleborough option which adds dedicated New Bedford/Fall River trains.

TABLE 15**Net Annual Operating Costs and Fare Box Recovery Ratios (\$1996)**

Alt. No.	Description	<u>Annual Cost (in \$ millions)</u>				Fare Box Ratio
		<u>New Annual Riders¹</u>	<u>Total Operating Cost</u>	<u>Revenue²</u>	<u>Net Operating Cost</u>	
1A	NB/FR via Attleboro	614,324	\$26.2	\$7.0	\$19.2	.27
1B	NB/FR via Attleboro - DMU Service	541,056	\$24.7	\$6.1	\$18.6	.25
2A	NB/FR via Middleborough	280,391	\$7.9	\$3.0	\$4.9	.38
2B	NB/FR via Middleborough - Skip Stop	455,107	\$16.2	\$4.6	\$11.6	.28
2C	NB/FR via Middleborough - Relocated Lakeville Station	301,526	\$7.6	\$3.2	\$4.4	.42
2C-1	NB/FR via Middleborough - New Lakeville Sta., Shuttle/Transfer	450,880	\$11.9	\$4.5	\$7.4	.38
3A	NB/FR via Stoughton	856,672	\$23.0	\$8.6	\$14.4	.37
3B	NB/FR via Stoughton - DMU Service	821,447	\$24.8	\$7.4	\$17.4	.29
4	Enhanced Bus Service	504,422	\$3.1	\$4.2	(\$1.2)	1.35

1. Annual new inbound trips(auto diversions), including 20% weekend ridership

2. Annual revenue includes 261 weekdays, plus weekend revenue at 20% of weekday revenue.

VIII. SUMMARY OF RESULTS

The analysis performed as part of this Expanded Alternatives Analysis is summarized below. A summary of the costs and benefits of each alternative considered can be found in **Table 16**.

Ridership Potential of the Alternatives

- An extension via the Stoughton Branch would have the highest ridership with 4,325 daily inbound train boardings. In terms of diverting commuters from the automobile and achieving air quality benefits, this alternative would also be the best. An extension via Attleboro would have slightly lower boardings of 3,230.
- Only Alternatives 1A or 3A, with service via Attleboro or Stoughton, would attract ridership at levels comparable to other MBTA commuter rail lines.
- DMU alternatives along either the Stoughton or Attleboro route offer twice as much service to Fall River and New Bedford, but ridership is 6 to 10 percent lower. This is due to current federal regulations which add a 7 to 12 minute time penalty for brake tests during DMU coupling.
- The commuter bus option would increase existing bus ridership by more than 100 percent. More than 3,500 passengers would use enhanced New Bedford, Fall River and Taunton bus service due to lower fares, free transfers to the MBTA rapid transit system and increased commuter parking availability. An estimated 1,790 of these commuters would be diverted from automobiles.
- Middleborough alternatives which simply extend Old Colony service have the lowest ridership potential with only 1,300 to 1,400 boardings. Middleborough options with more competitive travel times and increased service levels still attract 35 to 50 percent less ridership (about 2,045 inbound boardings) than the Attleboro and Stoughton options.
- The use of supplemental shuttle service to increase ridership on the Middleborough line alternatives could also be applied to the Stoughton and Attleboro alternatives. This would further increase ridership levels on these routes and amplify the relative benefits of these routes as compared to the Middleborough line options. The relocation of Lakeville station would reduce travel time by about 10 minutes, but would have a minimal impact on ridership.
- Low ridership on the Middleborough alternatives is due in part to the fact that these options do not serve Back Bay station. Back Bay station is the ultimate destination for 40 percent of existing MBTA commuter rail passengers on the south side.

- The North Easton and East Taunton stations are the highest ridership generators, with potentially over 1,000 passengers each.

Potential Environmental Impacts

- The level of potential impact is minimal to nonexistent along the Middleborough route. The Attleboro and Stoughton routes have a much greater potential for environmental and community impacts.
- Wetland impacts would be minor along the Middleborough route (5,000 square feet), more significant along the Stoughton route (2 acres) and most significant along the Attleboro bypass (5.4 acres).
- Both the Stoughton and Attleboro routes would require wetlands variances. While the Stoughton route has fewer wetland impacts than Attleboro, it passes through the Hockomock Swamp Area of Critical Environmental Concern (ACEC) and may be more difficult to permit.
- The Stoughton route would result in noise impacts to the largest number of abutting residential and commercial properties. Furthermore, there is currently no train traffic along this proposed right-of-way. The Attleboro route would also impact many residential and commercial properties, but these properties currently abut an active railroad right-of-way.
- The number of grade crossings is greatest along the Stoughton alignment. All 24 of these at-grade crossings would be new. The Attleboro alignment would have 20 grade crossings, but only one is not in existence today. Three of the Middleborough alternatives would involve 5 existing grade crossings. Alternative 2B however, due to increased train operations, would involve the 21 crossings located along the Middleborough Line between Braintree and Lakeville.

Operational Issues

- The level of service assumed previously on the Northeast Corridor has been reduced somewhat from the 1995 Feasibility Study levels as a result of a detailed simulation of operations along this route. The number of trains passing through Taunton, Norton, and Attleboro along the so-called Attleboro route would be 36 daily (as opposed to 44).
- Schedules for the three Old Colony branches are uncompromising ones that have been developed to work within Main Line capacity constraints. Even without New Bedford/Fall River service, it will be challenging to maintain acceptable levels of on-time performance on the Old Colony system.

- Middleborough alternatives which simply extend service (2A, 2C and 2C-1) would not be able to accommodate both New Bedford/Fall River and Old Colony passengers without adding additional trains. The addition of New Bedford/Fall River passengers could put Old Colony Middleborough line service 27 percent over MBTA service standards for passenger loading.
- The addition of New Bedford and Fall River trains to the tightly constrained Old Colony Main Line was tested under Alternative 2B. The results demonstrated that increased train traffic would have significant impacts on the level of service provided to Old Colony passengers. During the AM peak, virtually all trains travelling the Main Line to South Station would be delayed. During the PM peak, all service would be late with the exception of one train. These delays could dead-lock service on all three Old Colony branches affecting the daily commute for more than 15,000 Old Colony passengers.
- Even Middleborough alternatives which do not add additional trains but simply extend planned Old Colony service would increase the potential for delays. The longer distances covered by each train would inhibit the ability to recover from minor service disruptions.
- Additional capacity can be added to the Old Colony system only by adding a second track north of Braintree. The level of development along this corridor in Dorchester and Quincy would require numerous property takings. Construction of a second track would cost over \$100 million in infrastructure, plus land acquisition and relocation costs of a significant magnitude.
- Relocation of the Middleborough/Lakeville terminal as presently being constructed as part of the Old Colony project would be feasible. However, relocation would require the MBTA to rescind commitments made as part of the Old Colony project and to reimburse the FTA for design and construction costs of up to \$5 million. Relocation would have minimal impact on ridership.
- It is recommended that the capacity of South Station, regardless of the alignment selected, be further investigated following the selection of a preferred alignment. This would be particularly important for any option that increased service on the Old Colony system, because the two platforms dedicated for Old Colony trains would be unable to accommodate additional trains during the peak periods.

The Use of Diesel Multiple Units

- In short consists, DMUs are more efficient to operate and maintain than locomotive-hauled equipment of similar capacity. However, the higher costs for each individual car limits their advantage to consists with less than 400-600 passengers.

- FRA safety regulations currently limit the realization of the full operational benefits of DMU technology. The need to perform a full brake test when coupling adds a 7 to 12 minute time penalty to each trip and reduces ridership potential.
- The cost and operational advantages of operating DMUs as short-haul shuttles should be further evaluated by the MBTA. The cost-effectiveness of such applications would increase if introduced in several places in the MBTA system.

Capital Costs

- The Attleboro and Stoughton alternatives are very similar in terms of total project costs, with the investment required ranging from \$407 million to \$410 million. The only feasible way to route service via Middleborough is by adding more trains, as evaluated under Alternative 2B. The need to double track the Old Colony Main Line north of Braintree would make this the most expensive alignment with total project costs estimated at \$436 million *plus* property acquisition and relocation. Middleborough branch alternatives 2A, 2C and 2C-1 have the lowest overall project costs, ranging from \$293 million to \$310 million, but these options are not feasible.
- Attleboro costs have increased from what was originally anticipated. The difference is due mainly to: the need for double track along the bypass; grade separation at Route 123; and the need to replace (rather than simply upgrade) track along the Attleboro Secondary.
- The implementation of DMU service would add an additional \$8 to \$10 million to the cost of each alternative for a dedicated maintenance facility.
- The commuter bus alternative has the lowest overall project cost of about \$22 million. These costs cover modifications to South Station, construction of 2,050 parking spaces, and the purchase of additional buses.
- The Stoughton alternative represents an option with very high service levels. Total project costs for this alternative could be reduced by about \$20 million by buying less equipment and stopping New Bedford/Fall River trains at all Stoughton branch local stops.
- All costs are in 1996 dollars. Inflation to the year 2000 or more would provide a more realistic estimate of expected costs.

Operating Costs

- The net daily operating costs for Middleborough alternatives are substantially lower than for other alternatives. This reflects the lower levels of service on these routes and the fact that operating costs north of Middleborough are absorbed as part of Old Colony operations.

- The Stoughton and Attleboro alternatives are almost twice as costly to operate than Middleborough options. Net daily costs for Stoughton are somewhat lower due to this alignment's more direct route to Boston as well as its higher ridership potential.
- DMU service operated via Attleboro or Stoughton would have gross operating costs that are in the same range as traditional equipment. However, longer travel times and lower ridership result in higher net operating costs for the DMU service.

Overall Cost Effectiveness

An extension via Stoughton would be the most cost-effective commuter rail alternative, with a fare box recovery of 37 percent and a \$130,000 investment per new transit rider. An extension via Attleboro would have a fare box recovery of 27 percent and require a \$190,000 investment per new rider.

Three Middleborough alternatives (2A, 2C and 2C-1) appear to have high fare box recovery ratios of 38 to 42 percent, but these options would not be feasible without constructing a second track north of Braintree and running more service to accommodate all passengers. Alternative 2B offers this additional service and, as a result, has a lower fare recovery ratio of 28 percent, about the same as the Attleboro route. The cost per new rider along the Middleborough route would be the highest, and at \$270,000 represents twice the investment required to attract new passengers along the Stoughton route. The cost-effectiveness of the Middleborough route would be further reduced once the actual costs of property acquisition in Dorchester and Quincy were factored in.

Analysis of the commuter bus alternative demonstrates that incremental fares would exceed the incremental operating costs.

TABLE 16
Summary of Alternatives

(Costs in Millions\$)

Alt. No.	Description	Daily Inbound Transit Riders	New Transit Riders ¹	Total Infrastructure Costs ²	Total Equipment Costs	Annual Operations Costs	Total Annualized Costs	Cost per New Rider ³
1A	NB/FR via Attleboro	3,620	2,180	\$355.70	\$51.20	\$26.20	\$62.60	\$0.19
1B	NB/FR via Attleboro - DMU Service	3,370	1,920	\$365.80	\$40.00	\$24.70	\$60.90	\$0.21
2A	NB/FR via Middleboro	2,430	995	\$252.80	\$39.80	\$7.90	\$34.00	\$0.29
2B	NB/FR via Middleboro - Skip Stop, Shuttle/Transfer	3,040	1,615	\$379.30	\$56.80	\$16.20	\$55.20	\$0.27
2C	NB/FR via Middleboro - Relocated Lakeville Station	2,500	1,070	\$265.40	\$39.80	\$7.60	\$34.80	\$0.29
2C-1	NB/FR via Middleboro - Relocated Lakeville Station, Shuttle/Transfer	3,045	1,600	\$265.40	\$43.40	\$11.90	\$39.60	\$0.19
3A	NB/FR via Stoughton	4,485	3,040	\$359.00	\$51.20	\$23.00	\$59.60	\$0.13
3B	NB/FR via Stoughton - DMU Service	4,360	2,915	\$371.70	\$50.00	\$24.80	\$61.50	\$0.14
4	Enhanced Bus service	3,500	1,790	\$13.00	\$8.80	\$3.10	\$4.80	\$0.01

1. Total inbound trips diverted from the automobile mode

2. Includes design, administration, contingencies and land acquisition.

3. Total capital cost (infrastructure + equipment) / New transit riders

